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NATURAL HISTORY

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NATURAL HISTORY.

PROCEEDINGS AND REPORTS

of the

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY

For the Session

1922 :: 1923

Price - - Five Shillings

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1924

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ARCHAEOLOGY.

The Council urgently request that any "find" of Archaeological interest in Ulster, should at once be reported to Mr. H. C. Lawlor, M.R.I.A., Hon. Secretary of the Archaeological Section, B.N.H.P.S., 8 Windsor Avenue, Belfast.

PROCEEDINGS AND REPORTS

— OF THE —

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

———FOR THE———

SESSION 1922-23.

EDITED BY
ARTHUR DEANE, M.R.I.A., F.R.S.E.
HON. SECRETARY.

Belfast:
THE NORTHERN WHIG, LTD., COMMERCIAL BUILDINGS, BRIDGE STREET

1924.

BRITISH MUSEUM
NATURAL HISTORY

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.
[ESTABLISHED 1821.]

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The membership of the Society consists of Shareholders, Annual Subscribers, and Honorary Members.

Shareholders holding more than two shares are not liable for an annual subscription, but shareholders of two shares pay an annual subscription of five shillings, and holders of one pay ten shillings.

In 1914 a new class of membership was created including persons of either sex, to be elected under the bye-laws of the Society, and admitted by the Council on payment of ten shillings per annum. Such members have all the privileges of the Society, and take part in any business of the Society not affecting the ownership of the property of the Society. In 1917 an Archaeological Section was founded. Persons wishing to join the Section must be members of the Society and pay an additional minimum subscription of five shillings per annum. An Application Form for Membership to the Society and to the Section will be found on page vii.

A general meeting of Shareholders and Members is held annually to receive the Report of the Council and the Statement of Accounts for the preceding year, to elect members of Council, to replace those retiring by rotation or for other reasons, and to transact any other business incidental to an Annual Meeting.

The Council elect from among their own number a President and other officers of the Society.

Each member has the right of personal attendance at the Ordinary lectures of the Society, and has the privilege of introducing two friends for admission to such.

Any further information required may be obtained from the Hon. Secretary at:—The Museum, College Square North, Belfast.

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BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

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**Died during their Presidency*

Belfast Natural History and Philosophical Society.

Founded 5th June, 1821.

Application Form for Membership.

To be filled up by the Candidate.

Name, etc. .....
[Please write name in full.]

Description .....

Residence .....

.....

....., being desirous of becoming a Member of the Society, I, the undersigned member, recommend..... as a suitable candidate for election.

Dated this.....day of....., 19.....

Signature of Member } .....

[Candidate must be known to the Member signing this form.]
[*All applications are subject to the approval of the Council.*]

Received ..... Elected by Council } .....

CONSTITUTION OF SOCIETY.

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ARCHÆOLOGICAL SECTION.

Persons wishing to join the Archaeological Section must be Members of the Society, and pay an additional minimum subscription of five shillings per annum. State below if you wish to join this section.

I desire to join the Archaeological Section.

Signature of Candidate } .....

[*All applications for Membership to the Section are subject to the approval of the Executive Committee.*]

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The Museum,
College Square N.

PROCEEDINGS OF THE BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY. SESSION 1922-23.

10th October, 1922.

In Assembly Minor Hall,
HENRY RIDDELL, M.E., M.I.Mech.E., President,
in the Chair.

JOHN J. WARD, F.E.S.

"STRANGE STORIES OF ANIMAL LIFE AND EVOLUTION."

Illustrated by Lantern Slides.

[*No Abstract.*]

31st October, 1922.

THE PRESIDENT: HENRY RIDDELL.

Presidential Address.

"THE BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY: THE STORY OF ITS PAST."

Illustrated by Lantern Slides.

[*No Abstract.*]

14th November, 1922.

HENRY RIDDELL, M.E., M.I.Mech,E., President, in the Chair.

PROFESSOR JAMES A. LINDSAY, M.A., M.D., F.R.C.P. (Lond.).

"THE RACES OF IRELAND."

Abstract.

A review was made of the physical bases on which the modern science of ethnographical research is conducted, and the difficulty of estimating their relative value was pointed out. The lecture was a broad survey, and the conclusions in regard to Ireland were as follows: —

The problem of Irish ethnology is admittedly one of great difficulty and complexity. Tradition is a frail guide. History is often obscure and imperfect, and not always free from bias and prejudice. Of true scientific investigation on modern lines there has been little until recent times. Our conclusions can often attain only to a certain grade of probability. Those conclusions may be summarised as follows:—

1. The local population of this country is of the Mediterranean stock, and has been here since Neolithic times—i.e., for four or five thousand years. It is more predominant in the south and west than in the east and the north, and it has everywhere undergone some infiltration from other stocks—mainly Nordics.
2. There is a large population of Nordic blood in Ireland derived from the following sources, viz.:—
   (a) The prehistoric De Danann people, Milesians, and Scoti.
   (c) The Danes, the Danish element being most abundant along the coasts—north, east, and south, less in the west.
   (d) The Anglo-Normans.
   (e) The Plantation settlers, English and Scotch, mostly in Ulster, but also in some of the central counties.

(f) The Cromwellians, especially in Tipperary and adjacent counties.

There is little evidence that the round-headed Alpine stock penetrated to Ireland, and the influence of the handful of Huguenot settlers upon Irish ethnology may be regarded as negligible.

History does not enable us to correlate with certainty the Celtic language and the Celtic culture which outspread the whole country with the above racial elements. Ethnologists are now agreed that the term Celt and Celtic cannot be assigned any definite connotation in the light of modern ethnological theory.

CONTRIBUTIONS TO IRISH ETHNOLOGY.

(From the Department of Anatomy, Queen's University, Belfast.)

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2. "THE PEOPLE OF RACHRAI" (Rathlin Island, Co. Antrim.)

MICHAEL A. MACCONAILL, B.Sc. *Member.*

The following description of the people of the Island of Rachrai is the result of a study made in July, 1923. It is based on general observations of the whole population, and on a series of measurements of males between 20 and 40 years of age. It is a great pleasure to record here the unbounded hospitality and the willing assistance of the island folk in this investigation.

The island of Rachrai is of great historical antiquity, being known to Pliny and Ptolemy. The earliest records describe Rachrai as a kingdom ruled by a Gaelic monarch who had a part in the Irish hegemony; and it was definitely recognised at the convention of Druim Ceata (A.D. 575) as an Irish land. The situation of the island, however, exposes it to attack from sea-rovers, to whom it offers a valuable retreat for and from raids on the neighbouring mainland of Ireland; and that it so served the Scots in the 16th century is well known. In the manuscript "The Battles of Conghaile Clarainech" one of these attacks at the beginning of the first century A.D. is described, the raiders being designated Norsemen. However that may be, Rachrai certainly was colonised by Norsemen during the 8th and 9th centuries in common with the opposite peninsula of Cantire. After the Norse invasions Rachrai was included in the Kingdom of the Isles, which comprised the Hebrides and other territories inhabited by a well defined race-group, the Gall-Ghaedhil or Norse-Irish. The tradition of the island, as recorded by Hill ("The MacDonnells of Antrim" c. 1873)—the Rachrai folk being then Gaelic speakers and the tradition, therefore, of historical value—seems to reach back to this time. This tradition derives the main additions to the population after the massacres (mentioned below) from Cantire, and it is a notable fact that this tradition of Scottish rather than Irish

Front and side views of R3, above, and R7, below.

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kinship still remains, for few Rachrai people settle in Ireland; those who leave, if they do not go to America, leave for Scotland. The Norse invasions, then, would have a definite influence on the racial characters of the islanders*. The next influences would be the immigrations after the massacres of 1558 (Sidney), 1574 (Essex†) and 1642 (the Campbells), the traditions of which were preserved till almost recent times; and in them the accretions to the population are held to be from Cantire. The common family names of the islanders, McCurdy (MacIllurdy, so found in the Norse chronicles of Argyll, c. 1160), Anderson, MacUaig (McCuaig), Weir, Coyle (from McDowell, McDougall), and Morrison, favour the accuracy of the traditions. The building of the West Lighthouse during the present century brought into the island a number of mainland Irish, northern and southern, some of whom have intermarried and remained; this may affect the characters of the population in a future survey.

In 1786 the Rev. William Hamilton, F.T.C.D., estimated the number of the people on the island to be 1,200, his figure being based on a census made by the parish priest. He has left a good account of the island as it was in his day, and of the people he writes:—"Small as the spot is, one can, nevertheless, trace two distinct characters amongst its inhabitants. The Kenramer [Ceann Ramhar] or western end is craigy and mountainous, the land in the valleys rich and well cultivated, but the coast is destitute of harbours. . . activity, bodily strength, and self dependence are eminent among the Kenramer men. Want of intercourse with strangers has preserved many peculiarities and their native Irish continues to be the universal language. . . . The Ushet end on the contrary is barren in its soil, but more open, and supplied with little harbours; hence its inhabitants are become fishermen, are accustomed to make short voyages and to barter. Intercourse with strangers has rubbed off many of their peculiarities, and the English

*The descriptions of the islanders previous to the 1st century are wonderfully like those of other parts of Ireland, the favoured are described as Danann people and the more ordinary as Firbolg in type.

†The island is said to have remained without inhabitants for 10 years after 1574 (Hamilto'n 'Calender," second series p. 556), but there are several stories (see Hill) of survivors, some of whom had reached Scotland.

language is well understood and generally spoken among them." He adds that such observations on so small an area may seem "speculative," but are a "matter of fact." They are equally true to-day, making allowance for the unifying influence of a common education in the one school of the island. Since the time of the famine of 1847, and on account of the opening up of America and industrial Scotland, the population has steadily dwindled until it is now only about one-third (380) of what it was in 1786. English is now spoken by all. The old people speak Gaelic; their immediate descendants understand it, but they do not use it; but the young people know no Irish but what they learn at school, and as this is the mainland tongue the Rachrai dialect may be said to be almost extinct

There are in the whole population only some 30 males between the ages of 20 and 40 years, and of these 20 were measured in accordance with the schedule prepared by Professor Walmsley. These measurements are detailed in Table 1.

Body Measurements:—The general body build is tall and broad. The mean height of the men is 1.746 metres, a figure most remarkably coincident with that recorded by Beddoe ("The Races of Britain") for the men of the southern parts of the West of Scotland. The range of stature of the Rachrai men is from 1.625 to 1.850 metres (5ft. 5in. to 6ft. 2in.); but 15 of the 20 men are above 1.70 metres, and only 5 are below that figure. The proportion of the acromial height to the stature is 80.45; the proportion of the bi-acromial breadth to the stature is 23.19; and the proportion of the span of the arms to the stature is 102.5.

Colouration:—The people are distinctly fair-skinned, and though there is, of course, considerable tanning of the exposed parts, in very few people is there any freckling. The skin is smooth and rather matt in texture. The eyes are light in colour in nearly all the islanders; and in the 20 men examined only one (R17, whose father was born in Dublin) has eyes which are heavily pigmented. The colour of the hair—if R17, in whom it is black, be omitted—is in one half of the 20 men dark brown and in the other half blond or red. The signficance of this distribution, however, which differs from that recorded by Beddoe, can hardly be

TABLE 1.

The people of Rachrai. The records and measurements of 20 males between 20 and 40 years of age.

No.	Age	Birthplace (*b*)			Body Measurements (in metres)						Weight	Colour of Eyes (*d*)	Hair		Head Measurements (in mms.)				Cephalic Index	Face Measurements (in mms				Nose Measurements (in mms)		Ear Measurements (Left)	Ear Measurements (in mms)
		Self	Father	Mother	Stature	Acromial Height	Sitting Height	Span of Arms	Bi-acromial Width	Bi-iliac Width			Colour (*e*)	Form (*f*)	Length	Breath	Height (*g*)	Min. Frontal Breadth		Naso-Mental	Naso-Crinion	Bi-zygomatic	Bi-gonial	Nasal Length	Nasa Width	Ear Length	Ear Width
(*a*)1	20	Rachrai	Rachrai	Co Antrim	1.75	1.43	(*c*)	1.79	.375	(*c*)	(*c*)	Lt Blue	Blond	Wavy 2	195	158	137	126	81.0	118	71	142	111	54	40	70	41
2	21	,,	,,	Rachrai	1.79	1.49	,,	1.90	.420	,,	,,	Dk Brown	Wavy 1	,,	194	155	130	118	79.9	120	74	140	117	57	35	72	47
3	26	,,	,,	,,	1.75	1.47	,,	1.79	.406	,,	,,	Gray	Brown	,,	198	155	131	123	78.3	112	65	140	110	49	40	65	43
4	28	,,	,,	,,	1.75	1.52	,,	1.83	.343	,,	,,	Lt Blue	Lt Blond	,,	200	148	133	117	74.1	12[illegible]	77	137	120	62	32	70	37
5	29	,,	,,	Co Antrim	1.80	1.49	,,	1.83	.387	,,	,,	,,	Dk Brown	,,	204	157	140	131	76.9	111	64	141	120	47	35	70	33
6	29	,,	,,	Rachrai	1.75	1.43	,,	1.78	.394	,,	,,	Gray	,,	,,	200	156	142	135	78.0	125	73	144	113	55	38	60	41
7	30	,,	,,	,,	1 82	1.50	,,	1.80	.375	,,	,,	Lt Brown	,,	,,	204	150	141	—	73.5	114	74	—	—	60	34	62	37
8	33	,,	,,	,,	1.82	1.58	,,	1.84	.425	,,	,,	Lt Blue	Brown	,,	203	157	141	132	77.3	135	75	147	120	59	36	68	37
9	35	,,	,,	Co Derry	1.85	1.56	,,	1.92	.406	,,	,,	,,	Red	,,	200	155	150	117	77.5	119	65	142	117	57	36	67	43
10	39	,,	,,	Rachrai	1.82	1.52	,,	1.92	.406	,,	,,	Dk Blue	,,	Wavy 2	195	145	126	125	74.3	124	71	138	115	56	40	60	35
11	40	,,	,,	,,	1.80	1.50	,,	1.84	406	,,	,,	Lt Blue	,,	Wavy 1	196	153	143	123	78.1	130	74	138	106	55	40	70	41
12	44	,,	,,	,,	1.76	1.56	,,	1.78	.381	,,	,,	,,	Blond	,,	212	160	139	127	75.5	132	77	150	120	61	41	75	41
13	22	,,	,,	,,	1.63	1.37	,,	1.69	.368	,,	,,	Dk Blue	Dk Brown	,,	186	155	140	120	83.3	117	64	140	100	46	34	64	30
14	23	,,	,,	Co Derry	1.69	1.43	,,	1.70	.419	,,	,,	Gray	,,	Curly	194	153	131	124	78.9	115	66	142	112	55	40	60	45
15	27	,,	,,	Rachrai	1.71	1.43	,,	1.67	.394	,,	,,	Lt Blue	,,	Wavy 1	198	152	133	130	76.7	117	65	140	105	56	36	60	34
16	28	,,	,,	Co Antrim	1.69	1.35	,,	1.75	.381	,,	,,	,,	Dk Blond	Wavy 2	195	155	139	125	79.5	123	73	140	120	57	37	64	37
17	29	Co Derry	Dublin	Co Derry	1.70	1.36	,,	1.76	.394	,,	,,	Dk Brown	Black	Straight	203	155	132	113	76.3	121	68	139	120	50	38	66	40
18	35	Rachrai	Rachrai	Co Antrim	1.62	1.41	,,	1.68	.394	,,	,,	Lt Blue	Blond	,,	183	150	145	122	81.5	118	69	130	106	49	31	67	30
18	36	,,	,,	Rachrai	1.68	1.42	,,	1.73	.384	,,	,,	Lt Blue	,,	,,	192	142	133	115	74.0	131	80	135	102	60	35	56	30
20	40	,,	,,	,,	1.73	1.45	,,	1.69	.368	,,	,,	Gray	Brown	Wavy 1	200	162	133	130	81.0	127	69	148	113	55	32	—	—
		Mean Values.....			1.746	1.46	,,	1 784	.395	,					198	159	137	124	77.8	122	71	141	113	55	37	71	39

NOTES.

(*a*) The names of the men are BLACK (4); MACUAIG (3); GLASS (1); McQUILKIN (1); McGUIRE (1); McCURDY (8); ANDERSON (2).

(*b*) All, with one exception (17), were born in Rachrai of Rachrai stock with which there is but slight admixture on the maternal side from the adjacent mainland.

(*c*) These measurements were not taken satisfactorily.

(*d*) The table used is:—Black, Dark Brown, Light Brown, Hazel, Gray, Green, Dark Blue, Blue, Light Blue.

(*e*) The table used is:—Black, Dark Brown, Brown, Light Brown, Red, Dark Blond, Blond, Light Blond.

(*f*) The table used is:—Straight, Wavy 1, Wavy 2, Curly, Frizzy.

(*g*) This measurement, which is the auricular height (auriculo-vertex), was taken with an instrument made after the pattern described by Hrdlicka in the in the Amer. Jour. of Anthropology Vol. 2.

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discussed on such a small number of observations; it will be entered into in a later paper. The form of the hair is slightly waved; in only 3 men could it be classed as straight.

Head Measurements:—The mean length of the head is 198 mm. (192-212 mm.), a correlation with the stature for the individual being fairly well indicated. The prominence of the occipital region, which is present in nearly all the men measured, is shown in the photographs of R3 and R7. The mean breadth of the head is 154mm. (142-162 mm.). The mean cephalic index is 77.8 (73.5-83.3) (Scots...77.8. Irish...77.9. Beddoe and Venn). The mean height of the head (from the interauricular plane to the vertex of the head) is 137 mm. (126-150 mm.); the mean height-length index is thus 69.7, and the mean height-breath index 89.8.

Face Measurements:—The face is long (mean naso-mental length 122 mm.) with high cheek bones (mean bizygomatic width 141 mm.) and a well developed lower jaw (mean bigonial width 113 mm.). The mean facial index is 86.7.

The nose is prominent with well developed alae, its mean length being 55 mm. and the mean breadth 37 mm.; the mean nasal index is 66.8. Its outline is straight or slightly sinuous, and the external nostrils are in a horizontal plane.

The ears are prominent and long and narrow, and the lobule only slighly developed in most of the men; its mean length and breadth are 71 and 39 mm.

30th November, 1922.

Henry Riddell, M.E., M.I.Mech.E., President, in the Chair.

Rev. Canon Archer, B.D.
" METEORITES."
Illustrated by Lantern Slides.

[*No Abstract.*]

12th December, 1922.

HENRY RIDDELL, M.E., M.I.Mech.E., President, in the Chair.

MICHAEL C. ANDREWS, F.R.G.S. F.R.S.G.S., F.R.S.A.I., F.S.A.Scot.

THE MAP OF IRELAND; A.D. 1300-1700.

SYNOPSIS.

Introduction—General Outline of Cartographical Periods.

I.—*Ancient Period*—Ptolemy.

II.—*Mediæval Period*—Mappae Mundi.

III.—*The Period of the Marine Charts*—Portolan Charts of the XIVth and XVth Centuries—Marine Maps of the XVIth Century. (1) Dulcert-Benincasa, (2) Roselli-Viegas, (3) Agnese, (4) Pilestrina-Martines, (5) Homen, (6) Olives .

IV.—*The XVIth Century.*—(1) Early Printed Period; (2) Manuscript Maps.

V.—*The Period from the Reformation of Cartography to Petty (1570-1680).* (1) Ortelius, (2) Boazio, (3) Mercator, (4) Speede, (5) Sanson, (6), Printed Marine Charts, (7) Petty.

It has sometimes been held that a map is the smybol of a country. For the period anterior to accurate and scientific surveying it would perhaps be more correct to say that the map of any country is a symbolic representation of the knowledge and ideas which the mapmaker had of that country. It is the progress of this knowledge and the evolution of these ideas concerning Ireland which are to occupy our attention this evening, and we shall illustrate these enquiries by the symbols—that is to say, the original maps—which were in use during the four centuries under consideration. To us the earliest attempts to map our island, and the gradual development and improvement of this original and very inaccurate form, should have a certain

attraction; but the cartography of Ireland derives a wider and more general interest from the circumstance that for a long period it was the most westerly land visited by the navigators of the Mediterranean; beyond which all was shrouded in the uncertainty and terrors of the " great sea of darkness.' '

GENERAL OUTLINE OF CARTOGRAPHICAL PERIODS.

In studying the development of the map of Ireland it must be remembered that we are dealing with a small section of the general history of cartography. A brief glance at some of the salient points of that history will be helpful as an indication of the main divisions into which our subject naturally falls.

It is known that the Egyptians constructed local maps at a very early period, and at least one example of Babylonian cartography, dating about two thousand years before the Christian era, is still preserved.

It is also recorded that maps were in use by the Greeks as early as 500 years before Christ, but we have no certain knowledge of their nature. It is probable that they also were of a local type, but we have reason to believe that the philosophers of that nation had already at an early date drawn designs to represent the world as then known.

Of Roman maps we know very little. The only example remaining to us being a thirteenth century copy of a road map of the empire known as the Peutinger Table; which, although of a very practical nature, does not lead us to believe that Roman geographers were highly advanced in the theory of map making.

The Greeks were not slow in applying their knowledge of astronomy and geometry to the measurement of the world, which science was eventually systematised and applied in detail by the great Alexandrian astronomer, Ptolemy, in the second century of our era. The work of Ptolemy has, without doubt, preserved for us all that was known of geography in the second century, but it exerted little or no influence on the cartography of the West in the succeeding ages. Some copies, however, were preserved in the eastern empire, translations from which were known to the Arabic

philosophers. It was not until his "Geography" was translated into Latin in the early part of the fifteenth century by Jacobus Angelus, and first printed in 1478, that it began to exercise that dominating influence upon the geographical ideas of the learned, which continued until the age of Mercator and Ortelius. That the original work of Ptolemy was furnished with maps, based upon the earlier productions of the Tyrian school, is hardly open to the doubt which has been cast upon it; that the maps as we know them in manuscripts dating from the twelfth to the fifteenth centuries, and in the numerous printed editions, represent those originals with any degree of accuracy is more doubtful. The preservation of these maps is ascribed to a certain Agathodemon, who, on very insufficient evidence, has been identified with an Alexandrian of that name who flourished in the VIth Century. The present form of the 27 ancient maps is due to Dominus Nicholas Germanus, who about 1466 re-drew them on a conical (or trapezoidal) instead of the earlier cylindrical projection.

Soon it became the fashion while preserving the ancient forms to introduce modernised maps in the work of Ptolemy; many of the editions thus occupying a position analogous to our modern atlases.

The long interval between the second century and the rise of the practical sailing charts in the thirteenth century was filled by a series of map designs of a very crude character, which are generally known as Mappaemundi. These diagrams, interesting as they are, as throwing some light upon the mediæval conception of the world, exercised no influence upon the development of cartography, but dropped entirely out of use soon after the revival and general acceptance of the Ptolemaic model.

The first maps of really modern type are those marine maps which are usually called Portolan Charts. The earlier examples were produced mainly by Italian and Catalan cartographers for the use of mariners, and were of a purely practical character, uninfluenced by Ptolemaic or other scientific ideas. Naturally they were almost entirely concerned with costal forms; with the headlands, bays, and river mouths, with the adjacent islands and the sea ports. Of their origin little is known. Nordenskjold believed that

what he termed the " normal portolan " was constructed in the thirteenth century from numerous coast sketches, while Theobald Fischer and Fiorini would put back their first appearance till the eleventh century, and suggest a Byzantine influence. An interesting record has been preserved of the crusade of Louis IX., which states that when, after leaving Aiguesmortes in 1270, the expedition was overtaken by a storm, the pilots brought *charts* to the king to show him their position. The earliest portolan charts now preserved are not, however, older than the first years of the fourthteenth century. The earliest dated example being the work of Petrus Vesconte, of Genoa, in 1311.

Even at this early date the coasts of the Mediterranean and Black Seas are drawn with that surprising accuracy which is typical of the whole group for the three centuries during which they were produced. Outside the Straits of Gibraltar the western seaboard of Europe, the north-western coasts of Africa, and the Atlantic Islands are often included, but with less accuracy, and with less fixity of form; indicating clearly that these regions had not been mapped for so long a period as the Mediterranean basin. After the great discoveries of the fifteenth century the scope of the marine charts was extended by the inclusion of the whole of Africa with parts of the two Americas and Eastern Asia, thus approaching more nearly to the character of true world maps.

The sixteenth century has been described by the Polish historian, Joachim Lelewel, as the period of " Continental " cartography, by which he means that map makers were then occupied in obtaining detailed information about countries, provinces, and kingdoms, and in making maps of their internal features rather than in merely laying down their coast lines. The work of this period is preserved both in manuscript and in printed form. In printed maps the German wood engravers were the earliest in the field; from about the middle of the century, however, the beautiful productions of the Italian copperplate engravers took the lead, until, after the labours of Mercator and Ortelius, the craft of map engraving settled for many years in the low countries, afterwards passing to England and France. The publication of the first edition of the Theatrum Orbis Terrarum by Abraham Ortelius in 1570 is usually taken as

the dividing line between mediæval and modern cartography. After this time we notice a steady progress towards improvement in the huge mass of material which was produced during the seventeenth century.

Upon examination of the materials available for the study of the development of the map of Ireland they will be found to fall naturally into the periods indicated by this general sketch, namely, the Ptolemaic, the mediæval, the period of the marine charts, the sixteenth century in manuscript and printed maps before Ortelius, and the post Ortelius maps of the late sixteenth and seventeenth centuries.

The cartography of Ireland has not, as yet, attracted the attention of many students. Something was done towards elucidating the place names by Lelewel in the middle of last century, and later by Hamy, by Baron Nordenskjold, and by Kretschmer, but we have no systematic work, such as that of Henri Harrisse for Newfoundland, of Gabriel Gravier for Madagascar, and of Dr. Bjornbo for Greenland. Until the late Mr. T. J. Westropp's illuminating paper on the early Italian maps of Ireland, which was presented to the Royal Irish Academy in 1913, we have only scattered and often very slight references in the all too few general works on the history of cartography. Mr. Westropp's work was, however, based entirely upon maps which have been reproduced in facsimile; if, therefore, we wish to expand his results and test his conclusions it is essential that we should study comparatively the *original material* which hapily exists in considerable quantity in the libraries of Great Britain, Europe, and America. The lantern slides used to illustrate this paper have, with few exceptions, been prepared from these originals, and will, it is hoped, give at least some general idea of the various forms assumed by the map of Ireland during the four centuries under consideration. As no particular map of Ireland is known of earlier date than 1489, and only a few are to be found between that date and 1572, our earliest examples must be taken from maps of the British Islands, from charts of the Western Coasts of Europe, and even from World Maps.

I.—*THE ANCIENT PERIOD—Ptolemy.*

The first of the Tabulae Antiquae in Ptolemy's Geography is a world map, the second is a map of the British Islands. The example selected is from the edition printed at Rome in 1490 from a copper-plate by Schweinheim-Buckinck, which was first published in 1478, and afterwards reprinted in 1507 and 1508 (Plate I., Fig. 1). Baron Nordenskjold thinks that the maps of this edition represent very fairly those of the earlier manuscripts. In the fifty-one editions of Ptolemy, published between 1478 and 1730, the ancient maps of the British Islands, although printed from fourteen different plates, are all of this type, with the exception of the map in the Bologna Edition of 1472 or 1482. The first thing which strikes us about Ptolemy's representation of Ireland is that it is far too long in proportion to its width, and that it is placed much too high relatively to England. A closer examination shows that it is about 6° too far to the north from the Equator, about 2° too far north relatively to England, and is about one fourth too long from north to south. The map has apparently been constructed by laying down according to the latitudes and longitudes of Ptolemy's tables, the fifteen river mouths, five promontories, eleven towns and nine islands, which are there given, and by filling in the remaining details more or less according to fancy. The identification of the Ptolemaic names appearing on the map of Ireland is a matter of great uncertainty. Joyce, writing in 1869, identifies only nine.

Probably the most satisfactory examination is that by Mr. Goddard H. Orpen, but some idea of the difficulty of the task may be gathered from his statement that "it is obvious that a mere resemblance of sound between Ptolemy's names and modern Irish is not a safe guide. We must take the very earliest known forms of the language, and applying the laws of Celtic phonology, reconstruct still earlier forms before we can gain even a probable basis for comparison, and we must always bear in mind that some of the names are possibly not Celtic at all."

The identification of the river mouths and promontories is probably the most certain, that of the towns is very uncertain, as no town properly so called existed, and the probability is that forts and strong places only are indicated,

Of these place names we need only here notice the interesting *Ivernis*, probably on the site of Cork, the city of the Ivernia, a tribe of that ancient stock which inhabited the South Coast from Waterford to Kinsale and gave their name to the whole island. Although modern maps of some few countries were introduced into editions of Ptolemy's Geography as early as Berlingheri's Florentine Edition of about 1480, no such map of the British Isles is to be found before the Venice Edition of 1511, by Sylvanus, which gives a wood cut map of Ireland of more modern form, but still retains the old names. In Waldseemuller's great Strassbourg Edition of 1513, printed by Ubelin and Essler, both the form and place names of the modern map are borrowed from the Portolan charts.

II.—*MEDIÆVAL PERIOD—Mappae Mundi.*

The Mediæval Period need not detain us long. Although Ireland is often to be found in the early Mappae Mundi it is represented in a very conventional manner by a circle or a rectangle bearing generally the name Hibernia, and in a few cases some inscription, such as that from Solinus which dilates upon the terrors of the passage across the Irish Sea, or a statement most uncomplimentary to Irishmen, " that they loved liberty more than labour." We have in this period no especial maps of Ireland such as the twelfth century maps of Matthew Paris and the Bodleian Map of Circa 1300, for England and Scotland, but in a few of the large Mappaemundi it is drawn in some little detail. A good example is the great map of Richard of Haldingham which dates from the closing years of the twelfth century, and is commonly known as the " Hereford Map " from the circumstance of its preservation in the cathedral of that city (Plate I., Fig. 2).

Squeezed into a convenient bay formed in the western coast line of Europe, and bounded by the circular margin of the map, the British Isles, and especially Ireland, take a very elongated form. The place names are few:—Civitas Bencur (Bangor), Ulvestr (Ulster), Civitas Divelin (Dublin), El Bande (R. Bann), Arhmata civitas S. Patricii (Armagh), Fl. Schene (R. Shannon), Velabri and Luceni (tribes according to Orosius I. 2), and Celdara civitas sancte Brigide (Kildare), with an adjacent mountain, perhaps that " Hul

of Kylar,'' whence, according to the legend related in Robert of Gloucester's Chronicle, stones for the erection of Stonehenge were conveyed by Merlin's orders. Of the adjacent islands Insula Arietum and Insula Avium probably represent the Island of Sheep and the Island of Birds in the legend of St. Brandan. Heccla and Vinencium are unidentified, while Svilla is perhaps meant for the Scilly Islands, but is more probably Scylla, a whirlpool, eddy, or rock, of which Paulus Diaconus mentions two lying between Britain and Spain.

III.—*THE PERIOD OF THE MARINE CHARTS*—

Portolan Charts of the Fourteenth and Fifteenth Centuries—Marine Maps of the Sixteenth Century.

From the great number of Portolan Charts and Marine Maps still preserved it is not so difficult as might appear at first sight to select examples to illustrate the development of the map of Ireland. By a close comparative study of about 250 charts, which include this island, it has become possible to distinguish six typical representations. It must not be supposed that every delineation of Ireland to be found in these charts will fall into this classification. Some examples appear to be transitional, while others are so small or so rudely executed as to be difficult to classify at all; but as nearly 200 maps can with certainty be referred to one or other of these six forms, an examination of typical examples only may serve to give a clear and not altogether superficial idea of the representation of Ireland for 300 years by the marine cartographers.

In the space at our disposal we must confine ourselves principally to an examination of the form of the island; any consideration of the large number of place names to be found in the series must be of a very general nature, although their comparative study is of considerable value in determining the relationships existing between the various types, while their identification with modern names is often of great interest. The difficulties of this identification in many cases may be understood when it is remembered that these place names were first collected from the strange speech of the natives of Ireland by the mariners and merchants of the Mediterranean basin, who must often have been both

illiterate and uneducated; and that when copied by the learned cartographers of Italy, Majorca, and Catalonia, they must in many instances have suffered the common fate of unfamiliar words.

TYPE I. DULCERT-BENINCASA.

The earliest representation of Ireland in the Portolan Charts is of such a form that it would certainly not be recognised if met with as an isolated map. It appears as a roughly six-sided figure of great width in comparison with its length. Its most marked feature is a great bay about the middle of the west coast, which is named "Insule Lacaris," the lake of the islands, and probably represents Clew Bay. The British Isles do not appear in the oldest charts, but the map of Ireland must have been well established at an early date, as it is to be found in its complete form in the maps of Petrus Vesconte (Genoa), 1318 and 1327, in those of Marino Sanudo (Venice), circa 1320, and of Dalorto or Dulcert (Catalan), 1325 and 1339. This original form was reproduced with but little variation for about 100 years, when it appears to have been revised perhaps by Battista Beccario (Genoa), 1426. A little later this revised map was made widely known by the great output of Grasiosus Benincasa, of Ancona, whose standardised form was copied without alteration in marine maps by many cartographers, until the last half of the sixteenth century. It was adopted as a Tabula Nova in many editions of Ptolemy's Geography from 1513 onward, and was engraved by Gastaldi as late as 1560. The earliest known separate map of Ireland, of about 1489, which is due to Henricus Martelus Germanicus, follows this form, but introduces a few place names from Ptolemy. The example selected for illustration is by Benincasa, and is dated 1468 (Plate II., 1). The northern regions are left nearly blank, but the place names on the west, south, and east coasts, are numerous amounting usually to about seventy, which is as many as occur in the whole of England, and greatly in excess of the Scottish names which usually number nine or ten only.

As the early Portolan Charts were produced almost exclusively by Italian and Catalan cartographers, some surprise may be felt at the evidence of such detailed knowledge of the Irish coasts. Mr. Westropp has, however,

shown very conclusively by means of extracts from the records that many of the principal Italian cities were carrying on a considerable and often direct trade with Ireland in the century immediately proceding our earliest maps, and that, therefore, the map makers had ample facilities for obtaining geographical information. The direct trade was principally with Florence and Lucca; and Florence, as we know, employed Venetian map makers. Florentines are found at New Ross as early as 1217, and in 1266 several merchants of that city were trading in Dublin. The great Florentine company of the Friscobaldi had branches in Ireland in 1282, while the Donati held the dues of Youghal, Cork, Waterford, and Dublin in 1284. Lucca merchants appear as early as 1171. The Ricardi company were collectors of customs, and lent money all over the South of Ireland. In 1285 the king ordered the controllers of the Irish wool trade to hand over its custody to this company. A certain Walter of Pisa was established at Dungarvan in 1260. Marsilius of Sienna was a " moneyer " in Ireland in 1297, while John Lumbard of Parma was a collector of customs in Dublin in 1335. No traces of direct trade with either Venice or Genoa are to be found, although there was indirect communication through Bruges, London, Southampton, and Provence, and there was an Irish Hospital at Genoa about 1160. The mass of records from which these few facts are selected are quite sufficient to account for the Italian knowledge of Ireland.

TYPE II. ROSELLI-VIEGAS.

The type which we have just examined appears to have held the field for about a century and a half without competitors. Shortly after the middle of the fifteenth century, however, a distinctly new form is met with. Although new it can hardly be said to be any improvement upon the established chart. It will be seen in the example reproduced, which is anonymous, of about 1489 (Plate II., 2), that the width is much reduced in relation to the length, and that Ireland does not extend so far north relatively to England and Scotland. The form is crude, being roughly an oblong rather pointed at the south-west. The horizontal north coast is not adopted by any other type of Portolan Chart. The only relationship with Type I. appears to be the great " lake of the islands " and the two rivers representing the Barrow and Suir. The series of place names is reduced to

about 60, of which only some half are to be found in the former type; a number of new names, especially those on the west coast, being very difficult to identify. It may be of interest to note that among these new names we find:— Quilibet or Quillebes (Killybegs), Balbir or Balbrich (Balbriggan), Maleyda (Malahide), Argalas or Argallam (Ardglass), Cuibelfat or Gulbefac (Belfast), and Galvey (Galway).

The fact that Galway never appears on the Portolan Charts of the first form is of some interest. It illustrates how fixed, almost crystalised, indeed, the sailing charts became after they had been once adopted, how slow they were to introduce new matter, and with what caution any internal evidence as to their date must be considered. In 1170 Galway was merely a fishing village; it was fortified by the O'Flaherties in 1230; in 1232 the De Burghs built a castle, and in 1178 it was walled. Perhaps during the period when the earliest charts were being developed it was not important enough to be noticed by the cartographers, but from 1274 onward its customs were consistently greater than those of Limerick, and we know that after the disastrous wars of Richard de Clare and the O'Briens of Thomond in 1310-1318 it grew and prospered apace. Nevertheless, the name of Galway never appeared on charts of Type I. although they were copied for 250 years after this date. It was only when a new form of Ireland was introduced about the middle of the fifteenth century that this flourishing seaport found a place in the sea charts. From this time it continued to be named in all the later types.

Judging by the small number of examples still extant this type of map does not appear to have met with much favour. Only six examples are known to me, the earliest, dated 1462, is by Petrus Roselli, of Majorca, the latest copied by a Portuguese, Gaspard Viegas, in 1534. It would be interesting to know why Roselli after using the original form of Type I. in 1456 departed from it in 1462 and afterwards returned to it in his charts of 1464 and 1468.

TYPE III.—AGNESE.

The third type of Ireland in the Portolan Charts is evidently derived from some independent source as may be seen by the very different series of place names as well as

by the greatly improved form. The source, however, is not at all clear, neither can the date of origin be fixed with any certainty. The acceptance of a date about the middle of the fifteenth century for the anonymous chart in the University Library of Upsala has apparently led Mr. Westropp to assume that the information upon which this type was founded was due to the extension of mercantile activity, which took place during the brief but brilliant reign of Henry V. (1413-1422). The fact that about 1420 the markets of Brabant were largely attended by Irish merchants as well as by Italians *may* account for an improved knowledge of Irish geography amongst the cartographers; but the date of this change of type can hardly be placed so early, as the Upsala Chart has probably been antedated some half century, and as we have no other map of Ireland in this form known to be of earlier date than the sixteenth century. The original of the example selected is in the British Museum, and was executed by an anonymous Venetian draftsman in the early years of the sixteenth century (Plate II., 3). The general proportions are much the same as those of the last type, but the map is more recognisable. The western extension of Donegal and Donegal Bay are indicated; Clew Bay is reduced to reasonable proportions; Galway Bay, the Estuary of the Shannon and Dingle Bay appear for the first time. On the south coast Waterford Haven takes a correct direction; on the east the principal feature is the double bay at Dublin divided by the Peninsula of Howth, which is a characteristic feature of the type. The northern coasts are rounded, and we notice an indication of the extension of Ulster towards the east. The place names, which are usually about 60 in number, also indicate a considerable accession of knowledge. About 30 are identifiable with names to be found in charts of Type I., but in nearly all cases the original spelling has been materially altered. Nine or ten names are apparently due to maps of Type II., but the remaining twenty are quite new.

These new names occur entirely on the west coast, and on the east coast from Dublin northwards. Amongst the latter we may notice:—Dalquei (Dalkey), Hou (Howth), and Langra (Larne).

This type was adopted by that prolific mapmaker, Battista Agnese, of Genoa, and continued to be copied until

the close of the sixteenth century, but in the later examples many of the old names are omitted and a number of new ones are introduced.

TYPE IV. PILESTRINA-MARTINES.

A fourth type of Ireland, which was even more widely adopted than the last, makes its appearance about the same time; that is to say, towards the close of the fifteenth century or the beginning of the sixteenth century. The form is evidently based largely upon our last type, indeed Mr. Westropp has not recognised it as distinct. That there is a difference will readily be seen from the beautifully executed map by Joan Martines, of Messina, dated 1582, which is reproduced (Plate II., 4). The improvements are trifling, and they are balanced by a retrograde step in the north and north east. Donegal Bay is much larger, Co. Mayo stands out more to the west, and the shape of Galway Bay is altered. In the north, however, the coast of Donegal falls away towards the east, while that of Antrim and Down is given less extension in that direction, thus considerably narrowing the northern portion of our island. The series of place names is rather longer, over 70 being usually found. A comparative examination of the names shew that nearly 60 are derived from maps of Type I. and II., about 10 are to be found only in Type III., while only some five are new. Unfortunately the latter have not as yet been satisfactorily identified. Charts of this type were produced in considerable numbers throughout the whole of the sixteenth century, and even as late as the middle of the seventeenth century by Vesconte de Maiollo of Genoa and his descendants, by members of the Majorcan family of Olives (Bartolomeo, Jaume and Domingo), by Matthew Prunes of Majorca, and by the author of our example, Joan Martines, of Messina, to whom we are indebted for some of the most beautifully executed charts of the period.

TYPE V. HOMEN.

Our fifth type is due to Portuguese influence. The cartographers of this nation who were very active in the second quarter of the sitxeenth century adopted the map which we have called Type III., with but little alteration in form and with few differences in the place names. It was not till after the middle of the century that Diogo Homen made such alterations as to justify us in assigning his map

of Ireland to an independent type. From the details of shape and the series of place names in the fully developed form as it appears in his fine charts of 1558, 1559, and 1560 (Plate II., 5), it is evident that they are based upon our third rather than on our fourth type. The principal variations are in the west and south west. Galway Bay is improved in shape, County Clare has much better proportions, and Loop Head is so named for the first time. The bold promontaries and deep inlets of Kerry and South West Cork made an appearance, if only in a tentative manner; but as an off-set against these improvements, we find a new and totally erroneous form adopted for the coasts of County Antrim. In the list of place names we find only some six or seven which have not been used in the earlier types of Portolan Charts. Of the remaining names, about 60 in all, the greater number are similar in substance, if not in form, to the original series employed in charts of Type I. We find 8 or 10 names which first occur in maps of Type III., but do not appear in those of Type IV., which confirms our view that the former type was followed. Homen's map of Ireland was copied with some variations by Antonio Millo, of Venice, in 1567, but does not appear to have attained a wide circulation.

TYPE VI. OLIVES.

Although the earlier members of the mapmaking family of the Olives or Oliva, of Messina, adhered to the form of Ireland which we have called Type IV., in the charts which they produced from 1532 to 1568, it appears that towards the close of this century the younger generation either originated or adopted a different form. This, our sixth and last type, was employed by Joan, Francesca, Brasito, and Salvatore Oliva, by Volzio, Guidaletto, and Placido Caloiro from 1580 until well past the middle of the seventeenth century (Plate II., 6). These charts are usually on a small scale, and Ireland is very poorly drawn. It assumes a long and narrow shape broader at the south, and tapering to a rounded form in the north. The detail is confused, and the outline is not so good as in the charts of the last three types. The series of place names is reduced to about 50, all of which are to be found in earlier maps, and which is certainly based upon that of Type IV. The reason of this retrograde step is not clear, but the production of this very

poor type of chart of Ireland long after much better maps, both manuscript and printed, were available is of little credit to the cartographers concerned. It is, indeed, a good example of the failure of the marine map maker, in the period of the decline of his craft, to adopt the great improvements which had been made by the newer and more accurate school of cartography, to an examination of which we will now turn.

IV.—*THE SIXTEENTH CENTURY*—(1)Early Printed Period.

Excluding the maps which appear in many editions of Ptolemy and those which were based upon them, the first *printed* representations of Ireland are to be found in a series of nine maps of the British Islands, the earliest of which is dated 1546, and the latest 1589.

With the exception of two (by Mollijns, of Antwerp, 1549, and Valvassorus, of Venice, 1556), which are wood cuts, the maps of this series are Italian copper-plates. The first of the series was published at Rome in 1546, and on the strength of the initials G.L.A. upon a band ornamented by three lilies, has been attributed to George Lily, son of the grammarian who lived there some years with Cardinal Pole. In these maps Ireland is shewn in a quite new but very debased form, which does not appear to have been influenced either by Ptolemy or by the Portolan Charts. The islands, headlands, and harbours which are such notable features in the marine maps are not named, the former being omitted altogether, while but few river estuaries are shewn. Three rivers only and fifteen town are named, the position of eight other unnamed towns being indicated. We have here probably the first and very poor attempt of the "continental" school as opposed to the "marine" school in the mapping of Ireland. Only one especial map of Ireland, with the title "Hibernia sive Irlanda," follows this type. It is anonymous and undated, but was probably published at Rome about 1560, and is the earliest *printed* map of Ireland which we have (Plate III.).

Although it has been narrowed considerably in its southern part, and the mountain ranges and forests are differently situated, the main coast outlines and the river system are exactly the same as in the map from the British Islands upon which it is based. The inscriptions are also

similar, and even the unnamed towns of the earlier map appear as buildings still without name. The map is placed with the south to the top, in which it does not follow any of the maps of the British Islands, one sub-group of which is placed with the west and the other with the north to the top.

The next type of printed map was also produced by the Italian copper-plate engravers, and was perhaps influenced by the fourth type of Portolan Chart, with the addition of a number of rivers, forests, and inland towns. The maps of this type are five in number. An anonymous example printed at Venice, which is dated by the British Museum authorities as about 1570, but which I am satisfied from certain internal evidence was engraved before 1566, is the earliest of the series. A scientific aspect is imparted to this map by the carefully drawn scales of latitude and longitude, which surround it in the form of a frame; but this appearance, we shall see, is entirely fallacious, as the scales are as inaccurate as they could well be. Indeed, the latitudes and longitudes laid down bear no reference to the map, and are worse than a fancy border because they are misleading. The example reproduced (Plate IV.) is by Porro, and was published by Porcacchi in his L'Isole piv famose del Mondo Venice 1572; it has been selected on account of its smaller and more convenient size, but lacks the scales of latitude and longitude just referred to.

When the position of places on the map are examined with reference to these scales it is found that Donegal is a little further north than Larn, and Achill Island lies on about the same parallel as Strangford; Galway is rather to the north of Drogheda, and Limerick is in the same latitude as Dublin. In short, places on the west coast are all much too far north relatively to those on the east coast. To bring them into correct position the whole map requires to be swung counter clockwise through the angle of about 20°. When we find that this map is not original, but is a very close copy of Ireland in Mercator's Map of Europe, published in 1554, this peculiarity is at once explained. Mercator's Map was constructed on a conical projection, Ireland occupying the extreme west of the sheet where the meridians are inclined at about 20° to the perpendicular. The copyist has paid no attention to the correct orientation,

but has drawn Ireland in the oblique position which it occupies on the original, and has then surrounded his map by scales of latitude and longitude exactly horizontal and vertical. As the copyist has so completely misunderstood, or at least ignored, the orientation of the original, it is perhaps hardly surprising that he has indicated in his scales a cylindrical projection instead of a conical, but it is difficult to understand why he has adopted such an erroneous proportion between his degree of latitude and long itude as 10 to 11, whereas the proportion at the central latitude of 54° as laid down by Mercator, so far as can be ascertained from the photographic reproduction, is the approximately correct one of 5 to 3.

In this map of Europe of 1554 we have the second earliest work that has been preserved of that great geographer, Gerard Kramer, commonly known as Mercator. Of his map of the Holy Land published in 1537 no example is known; one example only of his map of Flanders published in 1540 has been preserved, and until 1889, when original copies were discovered in the Stadtbibliothek of Breslau, Mercator's maps of Europe, 1554, and of the British Island, 1564, were quite unknown. These unique examples, together with a second example of his *World Map* of 1569, found at the same time, have been reproduced in photographic facsimiles of full size, and are now happily available for students of cartography.*

An illustration of the fugitive nature of maps, even of large size, as compared with printed books is to be found in the archives of the great Antwerp publishing house of Plantin, which record that between the years of 1558 and 1576 868 examples of Mercator's Map of Europe were sold, while to-day a single example only is preserved to us.

(2) Manuscript Maps.

Turning from the Italian school we must glance at the local work of the sixteenth century. We know of only seven examples depicting Ireland alone. The earliest of these is anonymous and undated, but from internal evidence it is believed to have been drawn before 1538.

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*NOTE.—Since this paper was read a second example of Mercator's Map of the British Isles, 1564, has been discovered in the Bibliotheca Alessandrina, Rome (see *Geographical Journal*, Vol. LXII. No. 1, July, 1923, p.p. 33-35).

It is described in the British Museum catalogue as: "A coloured map of Ireland, which is represented as of "quadrangular form, very rudely drawn on vellum, with "buildings to mark the site of the principal places; executed "temp. Henry VIII."

Mr. Dunlop, in his catalogue of Sixteenth Century Maps of Ireland, says:—"The disproportionate space assigned to "the district between Dublin and Carrickfergus along the "coast, and the extraordinary length of the river Boyne "between Drogheda and Trim, lead naturally to the con-"clusion that it is the work of someone better acquainted "with the English Pale than with the rest of Ireland . . . "It is instructive mainly as bringing vividly before us how "vague and meagre the geographical knowledge respecting "Ireland was at the time when Henry VIII. was meditating "the 'recovery' of the country."

One most interesting feature has, however, not been noticed. The map is a very early example of a class which became popular in the eighteenth and early nineteenth centuries—the road map. On it three main routes from Dublin are plainly indicated:—

(1) The north road to Drogheda, through Swords and Balbriggan.

(2) A road to the west crossing the Boyne and proceeding through Trim and Athboy to Delvin.

(3) The south road through Naas, crossing the Liffey at Kilcullen, and proceeding through Castledermot and Carlow to Leighlinbridge, where it crosses the Barrow.

Our next example is thirty years later. It is signed John Gough or Goghe, and dated 1567. The compiler of this map was evidently better informed than any of his predecessors as to the contour of the island, especially on the north and west coasts. The map contains numerous additions in the hand of Cecil.

Other manuscript maps of Ireland are two by Lawerence Nowell, Dean of Litchfield, of about 1570 or 1572, which appear in a volume of the Cotton Collection in the British Museum, containing abstracts of Flattesbury's Annals, entitled "An abbreviate of the getting of Ireland and the decay of the same" and "A description of the Power of

Irishmen ''; and one by the same author in the collection of the Marquis of Landsdowne. A large map of about the same date preserved in the British Museum has been also assigned to Nowell, but according to Mr. Dunlop, may with more probability be ascribed to Robert Lythe, an engineer, previously employed by the Government as surveyor in the English Pale in France, who in the autumn of 1567 was appointed by Cecil to construct from personal observation a map of Ireland. Owing to its bad condition it is very difficult to decipher the inscriptions, many of which are entirely washed away, while the remainder are so obliterated as to be hardly legible.

In Trinity College, Dublin, there is an early map by Baptista Boazio, undated, but probably executed about 1575-76, it is partly a compilation and partly the result of personal observation. Nothing is known of Boazio except that, as his name implies, he was an Italian who was employed by the Government as a map maker about 1575-1600. His work is very fine and accurate.

Although they did not produce any complete maps of Ireland which have been preserved, mention should be made of John Browne and Francis Jobson, by whom we have several county and provincial maps. Of Browne, who died in 1592, not much is known except that he was probably the nephew of John Browne, of the Neale, in County Mayo, one of the first English settlers in that part of the country and direct ancestor of Lord Kilmaine. His maps are some of the best we possess.

Francis Jobson went to Ireland about 1579. In 1585 he was appointed joint '' measurer '' with Robt. Lawson and Whitacre to survey and draw into plots the forfeited lands of the Earl of Desmond and his retainers in Munster. Afterwards he was employed by the Government in mapping Ulster.

V.—*THE PERIOD FROM THE REFORMATION OF CARTOGRAPHY TO PETTY (1570—1680).*

Having briefly surveyed what may be termed the '' Early Printed Period '' and glanced at the Manuscript Maps of the sixteenth century, we have arrived at the reformation of cartography, with which the names of Gerard

Mercator and Abraham Ortelius are inseparably connected. The contrast between these two great men, the former poor, persecuted, and imprisoned, driven from his home, and labouring with his own hand to perpetuate the fruits of his learning, the latter living in peace and prosperity among his many friends and dependants, has been too often drawn to need repeating here. I may, perhaps, turn aside for a minute to relate the story of the origin of the first modern atlas as it is told in a letter written in 1603 by Raedemacher to Jacob Cools, the nephew of Ortelius. Raedemacher in his youth was employed in the shipping house of Gilles Hoftman, of Antwerp. His master, although not a man of letters himself, took a great interest in geography, and made much use of maps in tracing the voyages of his many vessels. As these maps were, according to the custom of that time, drawn on rolls and were often of great size they were difficult to store and awkward to consult. Raedemacher relates how, at his suggestion, his friend Ortelius was employed to bring together a collection of such maps as he could find of the size of one sheet, which he did to the number of thirty-eight, binding them in book form, to the great comfort of the old merchant. It can hardly be doubted that this volume, now unfortunately lost, gave Ortelius the idea of publishing his first collection of maps.

In attempting to indicate briefly the development of the map of Ireland for the century which elapsed between the map published by Ortelius and that by Sir Wm. Petty, we have to deal with a considerable amount of material, although the number of the maps is not nearly so great as in the period of the Portolan Charts. Applying the same system of comparison and classification we can again refer each of these individual examples to one or other of certain typical forms.

The increasing rapidity of progress in cartography may be appreciated when we find that although the work of the marine cartographers for three centuries can be illustrated by six typical forms, seven are required for the study of printed maps of Ireland during one hundred years. The quick succession of varying forms serves to remind us that until the time of Petty's survey, enough was not known of the geography of Ireland to enable any cartographer to produce a really accurate map of the island.

(1)—*Ortelius.*

The first edition of the Theatrum Orbis Terrarum was published in 1570. It contained a map of the British Islands, but none of Ireland. In the first Additamentum of 1573 this omission was rectified by the publication of the map now reproduced in outline (Plate V., 1). Although containing more detail than any we have yet examined it is still very poor in form. It is, however, not original, and the type must be antedated nine years. It is an exact copy of the Ireland from Mercator's map of the British Islands, published in 1564. We know from Mercator that he did not, in accordance with his usual custom, design this map himself, but only engraved it from drawings supplied by some English friend. Who this friend was we do not know, but perhaps the wildest of several suggestions is that which attributes its authorship to William Camden, the historian, who was only thirteen years old at the time. This map appeared in the various editions of the Theatrum until 1595, but seems not to have been copied elsewhere. We may notice particularly the very inaccurate form of the west and south-western coast lines, the lack of detail in Donegal, the disproportionately large size given to Lough Erne and the bad shape of Lough Neagh.

(2)—*Boazio.*

The next type is due to Baptisto Boazio, of whom mention has already been made, the earliest printed example of which is preserved in Trinity College, Dublin. This map which is based upon a somewhat earlier manuscript (1575-6), may be pretty safely assigned to 1578-80 (Plate V., 2). The Trinity College example seems to be unique, but a copy was engraved by Pieter Van Der Kiere and published by Judocus Hondius in 1591. This type was adopted in the 1602 and later editions of the Theatrum of Ortelius, published by Vrints, but does not appear to have been used elsewhere. The great improvement in the form of Ireland is evidently due by some more accurate system of survey. Especially worthy of notice are Galway Bay, Loop Head in County Clare, and the south western promontories of the counties of Kerry and Cork, which are of nearly true form. The eastern coast, although somewhat too flat in its southern half, is much improved from Dublin to Fair Head. Although very flat the proportions of the northern coasts are better. Little

can be said for the west coasts, which still fail to give any projection to County Mayo. It may also be observed that Lough Erne has retained its great size, is filled with a multitude of islands, and is placed much nearer the coast, reminding us of the " insule lacaris " of the early Portolan Charts.

(3)—*Mercator.*

In Mercator's Atlas the map of Ireland did not appear until the third volume published in 1595, four months after his death (Plate V., 3). Here Mercator departed widely from the form given to Ireland in his map of Europe published 31 years previously; indeed, he has adopted in most respects, but with many differences in detail, the improvements of Boazio. For instance, it may be noted that Lough Erne is again removed inland, and that Lough Neagh is much reduced in length. This map continued to be published in many later editions of Mercator's Atlas, and was copied in Camden's Britannia, but never seems to have become popular. It was followed, however, about a century later in a large map of Ireland on two sheets published by Coronelli, the Venetian geographer.

(4)—*Speede.*

The fourth book of John Speede's " Theatre of the Empire of Great Britain " was published in 1612, and contains a map of Ireland engraved by Jodocus Hondius (Plate V., 4). The actual author of this map is not known. It will be seen that it is a considerable improvement on Mercator's Map, especially in the north coast, which now takes a rounded form in place of the flat top of the last two types. Lough Erne is divided into two parts and reduced to better proportions. These, and other improvements, indicate an extension of local knowledge, and would lead us to suppose that the map was founded upon recent surveys. If we may rely upon certain internal evidence of a suggestive but not entirely of a convincing character, it is more likely that Speede's map is based upon the survey completed by Robert Lythe in 1572 than upon the later one by John Norden in 1609-1611. The adoption of this map by the two great rival houses of Blaeu and Jansson, may be taken as an indication that it was the best in existence at that time, while their

immense activity in cartographical output caused it to be very well known. Maps based upon it were also issued by F. de Wit and Carolus Allard about 1660-1680.

(5)—*Sanson.*

The earliest especial map of Ireland of the French School which I have been able to find is one by Nicolas Sanson, of Abbeville, dated 1665. But the same form of Ireland was used by him in his map of the British Islands as early as 1640 (Plate V., 5). His map of Ireland does not seem to have been greatly copied, at least I have not been able to obtain any example other than a somewhat distorted one by Pierre du Val, dated 1685. In maps of the British Islands, however, he was followed freely by De Wit, Valck, Jaillot, Nicolas de Fer, and as late as 1742 by le Sieur Robert, cosmographer to the King of France. The map contains some improvements on Speede's, particularly in the coast of Antrim, but still fails to give any western extension to Connaught.

(6)—*Printed Marine Charts.*

Before passing to a notice of the last map of the series it should be pointed out that running side by side with the productions of the "Continental" school, a different, and in some respects more accurate, type was being issued by the "Marine" school of cartographers. Owing to the rarity of the early collections of printed sea charts, such as that of Waghanaer, and the difficulty of obtaining sufficient examples on single sheets, any complete study of this interesting type has not been possible; but it is certain that nearly two decades before the date of the first "Continental" type map of Ireland, which gave Connaught its western extension, this coast was shown in marine charts with a fair approximation to correctness. The map reproduced is by Pietre Goos, and is dated 1666 (Plate V., 6), but an earlier example by Jansson is known dating from 1657, which was sixteen years prior to the first engraving of Sir Wm. Petty's map in 1673, and twenty-six years before it became generally known by the publication of his Hibernia Delineatio in 1683.

(7)—*Petty.*

On the 10th September, 1652, Dr. William Petty, formerly Vice-Principal of Brazenose and Professor of Anatomy at Oxford, landed at Waterford to take up the post of Physician-General to the Army in Ireland. He was then

twenty-nine years of age. Before long we find him putting forward a scheme for the better execution of the survey of the forfeited lands, which was necessary for the promised distribution to the adventurers and soldiers, who were to be paid in land instead of money. In October, 1654, his proposals, after great opposition from the Surveyor-General, Benjamin Worsley, were approved of, and he was given control not only of a survey with maps on a large scale of the forfeited lands, but also of the preparation of a general county and barony map of the whole of Ireland for public use. This task (to the amazement of Worsley, who reckoned it would take some years) he undertook to perform in thirteen months if, in his own words:—

> "The Lord gave reasonable weather, and due pro-
> "vision be made against Tories, and that my instru-
> "ments be not found to stand still for want of
> "bounders."

Starting in April of the next year he organised a staff of one thousand persons, provided them with the necessary instruments and materials and completed his task very nearly within the time limit. Surveying in Ireland at that time was no child's play. We learn that several of his men were taken and murdered by the Irish chiefs, who identified the survey with the loss of their lands. That Petty, who had no previous knowledge of the work, should have been entrusted with an undertaking of such magnitude and difficulty speaks volumes for his personal influence and diplomacy; that he carried it out in the time and manner that he did is a high testimony to his business ability and power of organisation. The matter was of great public importance, and Petty, working under heavy disabilities, and against great opposition, may be said to have saved the situation.

After the completion of the survey Petty further undertook the difficult and thankless task of distributing the lands to the various creditors; but in this work, and in his subsequent struggle with the Government to obtain the stipulated payment for his labours, we need not follow him. It will be sufficient to remark that his capacity for business did not fail him, as he seems in these years to have laid the foundation of a very handsome fortune.

When Petty began work the only available information was:—

1. An old Survey of Tipperary and parts of Connaught made under Strafford.
2. Such portions of the "Grosse Survey" started in August, 1653, as were completed.
3. The "Civil Survey," which was merely a list of lands without maps or plans.

The idea of a survey in the present day is indissolubly connected with the notion of a map, but this was not always so. A survey, at that time, was usually a specification of lands partaking of the character of what to-day would be called a valuation list or register. Petty's survey is known as the "Down Survey," because it specified in his contract that the lands were to be surveyed "down" on a map. Considering that the work was done entirely by the chain, it was of considerable accuracy. Authentic copies of his maps were accepted in the law courts; and according to Sir Thomas Larcom, writing in 1851, they then constituted the legal record of the title on which half the land of Ireland was held. According to Petty, his complete map of Ireland, which was declared by Evelyn to be "the most exact map that ever yet was made of any country," was engraved at Amsterdam in 1673 at a cost of £1,000.

The example reproduced was published 10 years later, and two years before his death in "The Hibernia Delineatio," which also contains maps of the provinces and of each county. Although we have no space to examine it in detail its distinctly modern and appreciably correct form, especially in the west, may be recognised at a glance (Plate VI.).

Up to this point progress was not continuous, but proceeded in a series of steps; each step being based upon the improvements effected by some individual whose work was copied until further improvement was made. These steps, which became ever shorter and shorter as improvement followed improvement at a quickening pace, allow of illustration by means of a limited number of typical examples. After the publication of Sir William Petty's map, which was at once accepted by cartographers, progress, though slow, became almost continuous. Interesting as the maps of the eighteenth century are, their number is so great, and their individual improvements so slight, that any attempt to describe them would result in a mass of detail which would be quite unsuitable for a brief sketch such as the present.

9th January, 1923.

In Assembly Minor Hall.
HENRY RIDDELL, M.E., M.I.Mech.E., President, in the Chair.

PERCY ALLEN.

"FROM THE PRIMITIVE DRAMA TO SHAKESPEARE."
Illustrated by Lantern Slides.

[*No Abstract.*]

30th January, 1923.

In Assembly Minor Hall.
PROF. GREGG WILSON, O.B.E., D.Sc., M.R.I.A., Past President, in the Chair.

H. C. LAWLOR, M.R.I.A.

"NENDRUM MONASTERY."
Illustrated by Lantern Slides.

[*No Abstract.*]

13th February, 1923.

J. M. FINNEGAN, B.A., B.Sc., Vice-President, in the Chair.

REV. CANON J. A. CAREY, M.A., R.D.

"THE HISTORY OF THE ART OF MUSIC."
Illustrated by Lantern Slides.

[*No Abstract.*]

27th February, 1923.

Dr. S. W. Allworthy, M.A., F.G.S., Vice-President, in the Chair.

A. Percy Hoskins, F.I.C., F.C.S.

"SOME POINTS, OLD AND NEW, ON THE VALUATION OF TOWN GAS."

Illustrated by Lantern Slides.

[*No Abstract.*]

6th March, 1923.

J. M. Finnegan, B.A., B.Sc., Vice-President, in the Chair.

G. O. Searle, B.Sc. (Agric.) Lond.

"THE BREEDING OF NEW VARIETIES OF FLAX."

Illustrated by Lantern Slides.

[*No Abstract.*]

27th March, 1923.

Dr. S. W. Allworthy, M.A., F.G.S., Vice-President,

Ivor Beaumont, A.R.C.A., M.S.A.

"THE PLACE OF ART IN EDUCATION."

Illustrated by Lantern Slides.

[*No Abstract.*]

"THE LARVA AND PUPA OF *TRICHOCERA REGELATIONIS* L. (DIPTERA, RHYPHIDAE)."

By J. G. Rhynehart, F.R.C.Sc.I., D.I.C. (Lond.), N.D.A., *Member.*

In February, 1921, some rotting swedes were received from a County Dublin farmer for examination and report as to the cause of decay. The rotted portions were found to be infested with large numbers of a Dipterous larva, which on superficial examination looked very similar to those belonging to the Tipulid group. These larvæ were feeding principally in the decaying portions of the "roots," but the sound tissue was also being attacked and devoured. The larvæ, therefore, appeared to be behaving as a pest, and, consequently, it was considered desirable to examine their habits and life history in some detail.

Many of the larvæ were, accordingly, caged with pieces of the decaying swede, while others were caged on pieces of fresh sound swede. These latter pieces were examined at intervals, but no traces of attack by the larvæ could be detected, and it was not until a certain amount of decay had appeared on the cut surface that feeding commenced. It is, therefore, concluded that unless the swedes are in a decaying condition they will not be attacked. Moreover, it was proved by experiment that the adult flies will deposit their eggs only in the decaying tissues and never on healthy swedes, so that primarily the larvæ which hatch from these eggs fulfil a scavenging function, but there is the possibility of their becoming free feeders on healthy tissue later, thereby inducing more rapid decay.

The larvæ that were caged on the decaying swede became fully fed, pupated, and the adult flies emerged from the pupæ in due course. The flies were submitted to Mr. J. N. Halbert, late of the National Museum, Dublin, who identified them as *Trichocera regelationis* L., a determination that was confirmed later by Mr. F. W. Edwards, of the British Museum, London*.

* Acknowledgments are gratefully made to these gentlemen for their kindness and help.

In February, 1922, an examination of decaying swedes at the Albert Agricultural College, Glasnevin, disclosed the fact that they were supporting large numbers of *Trichocera* larvæ. These larvæ were reared through to the adult stage and identified as *Trichocera regelationis* also.

The existing literature on the immature stages of the *Trichoceræ* is somewhat fragmentary, while some of the published illustrations of the larvæ are apparently incorrect.

It is thought desirable, therefore, to publish the notes made during the observations on the life of this insect, and to incorporate with them short illustrated descriptions of the larval and pupal stages.

The study of the mouth parts of the larva was a fascinating one, and disclosed many features of exceptional interest.

Species of Trichocera larvæ have, for a considerable time, been known to live in decaying vegetable matter—especially swedes and turnips—and were regarded as desirable scavengers. Curtis (5) refers to the larvæ of *Trichocera hiemalis* as frequenting rotten turnips, and gives short illustrated† descriptions of the different stages.

Ormerod regards the larvæ of *Trichoceræ* as beneficial " for the maggots living in putrid and moist parts of the turnip bulb help to get rid of foul useless matter " (14). In 1893 she reports the occurrence of *Trichocera regelationis* larvæ in rotten turnips, and appends general descriptions of the larva and pupa. These desciptions follow closely, even to the reproduction of figures, those previously published by Curtis. Theobald (16), again, makes use of Curtis's original figures, and regards the *Trichoceræ* as being beneficial rather than injurious.

In 1907, however, Johannsen (6) records *Trichocera regelationis* as a pest of potatoes in Maine, while in 1911 Carpenter (3) reports damage to swedes in Ireland which was attributable to an allied species—*Trichocera fuscata*. In the latter case the larvæ " were feeding on the fresh tissue of the swedes, and appeared to be the main cause of the decay

† The figure of the larva is obviously incorrect as is also the description. Both would appear to have been made from a larva belonging to the Cyclorrhapha division of Diptera.

that was spreading through the roots." Carpenter, moreover, reports the receipt of potatoes from Co. Galway which were being eaten by the larvæ of a species of *Trichocera*. It is thus seen that whilst under certain conditions these larvæ may be regarded as harmless, or even beneficial, they must on other occasions assume economic importance by reason of the facility with which they attack and devour sound tissue as well as that undergoing decay.

Life History. Many of the larvæ received in February, 1921, were caged along with portions of the rotting swede, a small quantity of fine soil being also placed in the cage. The larvæ continued to feed during the early part of March, but on the 20th of March five were seen to have pupated, four in the soil and the fifth in the rotting tissue of the swede. During the feeding period the larvæ are not easily seen, as they burrow deep into the rotting portions of the bulb. They do not appear to dislike excessive moisture, and are capable of existing for long periods under such conditions. It was proved by actual experiment that larvæ can live for many days feeding on a piece of swede that was completely immersed in a dish of water. When living under such conditions the posterior spiracles are always held above the surface of the water. This is effected by the fringes of bristles (Plate 1, Fig. 12) on the four processes of the posterior segment spreading out fan-wise, thereby buoying up the posterior end of the body while feeding proceeds.

The first adults emerged from the caged larvæ on the last day of March and emergence continued during the first fortnight of April. On the 4th of April two females and one male, all of which had emerged two days previously, were caged on a piece of rotting swede. Egg laying commenced on the 12th of April, so that the pre-oviposition period under laboratory conditions was nine days. The female fly inserted the eggs into the tissue of the swede usually horizontal with the surface; they are, however, never found inserted in the sound portions, but are seen as whitish bodies in the deeper-coloured yellow, rotting portions. The caged flies died on the 14th of April after twelve days of life in the adult stage.

The eggs hatch in seven or eight days, and the little larvæ which issue therefrom commence to feed immediately. They are quite happy even when there is abundant moisture

as a result of decay in the swede. As feeding proceeds the larvæ increase rapidly in size until after about thirty days they become fully fed. The different larval stages could not be determined with certainty owing to the feeding habit. When fully fed the larvæ usually leave the tissue of the swede and go to the neighbouring soil. In this a crude chamber is constructed in which the full grown larva transforms to the pupa. Pupation may, however, sometimes take place in the tissues of the attacked swede. The pupa is comparatively active, and especially so shortly prior to the emergence of the adult, when by continued wriggling it pushes its way, head foremost, towards the surface of the soil until at the time of emergence the head portion of the pupa is actually above the surface of the soil. This upward movement of the pupa is effected by the series of spines which are present on each segment (Plate III.).

The emergence of the adult is effected by the splitting of the pupal cuticle down the mid-dorsal line of the thorax. Through this rupture the adult emanates, the last parts to be freed being the hind legs and the tip of the wings. The pupa stage extends from eleven to fifteen days. The complete life cycle from the production of the egg until the resulting adult produces eggs again therefore occupies about sixty days. Since the adults are seen all the year round, though commonest during fall and spring, it is likely that one life cycle follows another throughout the year.

Descriptions of the Immature Stages.

(1) *Egg* (Plate I., Fig. 1). The egg is white in colour, elongate, bluntly pointed at both ends and thickest at the centre. Length 0.47 mm. Greatest breadth 0.17 mm. Surface granular in appearance with minute processes projecting therefrom.

(2) *Newly Hatched Larva* (Plate I., Fig. 2). The published writings on the *Trichoceræ* contain little reference to this stage. The larva after hatching is about 1.5 mm. long and 4.2 mm. broad at the centre. It is a legless grub, almost transparent, and shows the tracheæ and other internal organs very distinctly. The general form is elongate, somewhat flattened dorso-ventrally. The head is comparatively large and dark-brown to black in colour. The mandibles and other mouth parts are very similar to those of the fully grown larva. The segments of the body are not

distinct, but at least eleven are distinguishable. The posterior segment carries two pairs of fleshy projections, each of which is provided with a fringe of fine bristles. A pair of spiracles is situated on the inside of the dorsal pair of projections. These are the only spiracles that are present at this stage. (Fig 9, Plate I., is a drawing of one of these spiracles.) The body is clothed throughout with fine hairs or pile which arise from the body cuticle in more or less transverse rows across the segments.

Fully Grown Larva (Plate I., Fig. 3). Various workers have studied the *Trichocerœ* in a general way, but so far as the writer is aware a detailed description of *Trichocera regelationis* has not been undertaken. Alexander (1) describes a supposed specimen of this species, while Johannsen (6) gives a short generalised description. Both these descriptions are useful for general identification purposes, and the reader may be referred thereto. The present writer's intention is to describe more fully certain larval structures, and especially the mouth parts, since these are of a highly interesting nature from the evolution point of view. The fully grown larva is from 7 to 7.5 mm. long and from 0.8 to 1.1 mm. in breadth. The sides of the body, from the first to the seventh abdominal segments, are more or less parallel. The form is elongate, slightly flattened dorso-ventrally. The pleuræ project as distinct ridges from the sides of the body segments. The colour of the body is yellowish to creamy white. The head is distinct, orange brown in colour, shining and capable of being retracted about one-third its length into the prothorax. Legs are absent. Four long and strong bristles (Plate I., Fig 7) occur at each side of each of the three thoracic segments and occupy positions analogous to those of legs. No doubt these bristles assist in the process of locomotion.

The posterior end of the body is provided with two pairs of fleshy projections each of which carries a series of long fine bristles (Plate I.. Fig. 12). The two ventral projections are the longer. The posterior spiracles are situated at the inner bases of the dorsal pair of projections. These spiracles appear as distinct brownish-black circular areas which on magnification exhibit a structure as shown in Fig. 10, Plate I. The anterior spiracles appear after the first moult, and are situated on the prothorax. They are minute brown-

coloured circular spots on the lateral margins, and are seen to project somewhat when viewed from the dorsal aspect. A drawing of an anterior spiracle is given in Plate I., Fig. 5.

The body segments are divided by transverse sutures. Each thoracic segment is thus indistinctly divided into two divisions, while the abdominal segments one to seven are divided by two sutures into three more or less distinct areas. The last body segment is placed ventrally, and is modified to form the anal plate. The latter is divided into four distinct parts by longitudinal and transverse sutures (see Fig. 6) at the intersection of which the anus opens. The posterior segment is capable of being pushed out or withdrawn at will and thereby assists considerably in locomotion. The eighth abdominal segment can, moreover, be retracted to a certain extent into the seventh, and this occurs each time the posterior extremity of the body is brought forward during progression. The body is covered with an abundance of fine hairs amongst which are many thickened sensory bristles. The eyes are small, black spots placed laterally just below the antennæ and in a transverse line with them.

The antenna (Fig. 4) appears to consist of two segments —an egg-shaped terminal one and a flattened basal segment which is situated at the base of a rounded pit. The basal segment carries a series of six elongated sensory structures.

Mouth Parts. Many different interpretations of the mouth parts of Tipulid and allied larvæ have been made, and, unfortunately, without much uniformity of nomenclature. Thus the different parts of the labium have received from different authors upwards of fourteen distinct names. The present writer, following the general arrangement of the mouth parts of Coleopterous larvæ, is obliged to depart from many of the opinions expressed by previous writers regarding the mouth parts of the larvæ of the Tipuloid type.

The mouth parts of *Trichocera regelationis* are peculiarly interesting inasmuch as there are present several paired structures which are not general in insects in the adult stage. Thus the epipharynx carries a pair of strongly chitinised toothed structures which may be termed epipharyngeal combs, and the hypopharynx has on its inner (buccal) face two distinct areas from which arise numbers of pointed

structures which from their position are suggestive of modified maxillulæ as described by Carpenter and MacDowell (4) and other workers from species of Coleopterous larvæ.

The labrum (Figs. 8 and 14) is distinct and strongly arched ventrally where it is continued to meet the epipharynx. It is provided with many bristles and the ventral portion would appear to be movable.

Epipharynx (Fig. 14). As already stated this is remarkable by reason of the presence of the two chitinised combs (Fig. 15), one at each side. Each comb is provided with seven strong teeth, and from their position these would appear to articulate with the equally strongly chitinised lacinial teeth. No doubt, these teeth supplement those of the mandibles in the process of food mastication.

Mandible (Figs. 16 and 17). This is an elaborate structure consisting of what would appear to be three distinct parts—a basal part, a terminal part provided with seven strong teeth, and an apparently movable prostheca situated at the inner side. This last named structure is provided with one large tooth and five smaller ones. Each mandible, in addition, carries two large tufts of long bristles—one arises on the dorsal surface near the base of the terminal toothed portion and the other on the inner surface to project inwards towards the buccal cavity. Two many-branched bristles are situated on the dorsal surface towards the lateral edge. The large adductor and the smaller abductor muscles arise as shown in drawing. The dorsal condyle is large and prominent. The mandibles work obliquely inwards and posteriorly. They are brought down in a sweep towards the centre and along the sides of the labrum. The terminal part of the mandible does not move independently of the base during this process. The mandibles are used largely for sweeping food into the ventrally placed buccal opening.

Maxilla (Fig. 18). The individual parts are not clearly defined. The palp is a rounded unsegmented structure, which is provided with a conspicuous rounded sensory organ comprising upwards of fourteen flattened papillæ. The galea and lacinia are fused, but both regions are perceptible. The galea carries a number of longish bristles and two two-segmented projections. The lacinia has on its inner face the six blunted chitinised processes already referred to. The cardo and stipes are apparently fused. They are roughly

rectangular in shape, and covered for the greater part with short bristles which arise in series of threes, fours, or fives. A small semi-circular portion situated towards the lateral margin is more strongly chitinised than the remainder and is not similarly clothed with bristles, only two short, stout ones being present thereon.

Labium (Figs. 19 and 21). After the head capsule has been thoroughly softened in caustic potash solution the labium will usually come away from the maxillæ with which it appears to be normally fused. The outline of the labium is shown in Fig. 19, Plate 2. It consists of a roughly rectangular shaped base, which is clothed with numerous long, fine, yellow-coloured bristles. These bristles arise usually in pairs and apparently in transverse rows. This base portion carries a rounded and much narrower portion which is not clothed with bristles, but which is provided with six or seven stronger bristles at each side adjacent to its base. This part, moreover, carries five pairs of minute projections and one pair of larger projections. The latter arise from palpifers, and may be regarded as reduced labial palps. By comparing the labium as described with a similar organ from the larva of a Coleopteron (*Longitarsus parvulus*) (15), the homology of the different parts is readily completed. The large rectangular portion of the labium of *Trichocera regelationis* is the submentum, and the narrower piece is the mentum. The two are completely fused. The ligula is bluntly rounded and, as already stated, is provided with five pairs of minute sensory-like projections and one pair of small one-segmented palps. It is interesting and highly suggestive to note that the ligula of the larva of *Longitarsus parvulus* is provided with an exactly similar number of sensory-like structures in addition to the pair of one-segmented palps.

Fig. 21 shows the mentum and ligula more highly magnified. The confusion in terminology regarding the mouth parts of larvæ referable to the Orthorrhapha Nemocera division of Diptera is apparent when it is realised that structures analogous to the mentum and ligula as described here have been variously described from other dipterous larvæ as hypopharynx (10) ; labium (11) ; endolabium (7), and mentum (12).

Hypopharynx (Figs. 20 and 21). This organ is well defined, and lies immediately above the labium projecting

anteriorly for some distance beyond the tip of the ligula. The anterior end is rounded, and is provided with many minute hairs, which arise in series. From its appearance the hypopharynx exhibits all the features of an organ of taste. On its inner side it carries a large number of small bristle-like structures, which arise from two well-defined areas, one on either side. One cannot help comparing these structures, both as regards nature and position, with structures described and figured by Carpenter and MacDowell (4) (Fig. 24) from certain Coleopterous larvæ. The pharyngeal plates (Fig. 20) are well developed and surround the pharynx. Organs which appear to be analogous to that here described as the hypopharynx have been variously described from other Dipterous larvæ as the ectolabium (7); endolabium (2); prementum (10), and mentum (13).

The Pupa—Plate 3.

The drawings on Plate 3 give a good idea of both the male and female pupæ. The male pupa is much smaller than the female.

Sizes—Male pupa 5.8 mm. long, 1.3 mm. deep, and 1.1 mm. broad; Female pupa 7.0 mm. long, 1.4mm. deep, and 1.3 mm. broad.

The posterior end of the pupa shows distinct sexual characteristics as can be seen from the drawings. The body is strongly curved at the posterior end; colour, very faint yellow all over except the thorax region, the extremities of the legs, and the posterior tip of the abdomen, which are darker. Transparent region towards posterior end of wing sheaths. Breathing horns prominent Segments of body divided by deep folds, the abdominal segments two to seven each having two such transverse folds, so that these segments have each three prominent ridges, the posterior ridge being provided with many spines and sensory bristles. The abdominal spiracles are prominent. The first abdominal segment is narrow. The three thoracic segments are provided with a number of short bristles, as shown in Fig. 24.

The eyes of the adult are prominent in older pupæ, but the secondary pupal eyes of Keilin were not observed.

De Meijere (10) gives a full description of the pupa.

Economic Considerations.

The larvæ of *Trichocera regelationis* can hardly be regarded as major pests seeing they do not originally attack sound tissue. If swedes or turnips have commenced to rot, however, the presence of the larvæ may quicken the process considerably, and such roots should be used up as quickly as possible.

Seed of good-keeping varieties of swedes should be sown and the excessive use of nitrogenous fertilizers avoided if rotting of the roots is anticipated.

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Description of Plates.

Plate I., Fig. 1. Egg.

,, 2. Newly hatched larva
an antenna, *psp*, Posterior spiracles.

,, 3. Fully grown larva
asp. Anterior spiracle, *psp*. posterior spiracles.

,, 4. Anntenna of larva.

,, 5. Anterior spiracle of fully grown larva.

,, 6. Ventral view of posterior end of larva.

,, 7. Group of bristles from leg region of larva.

,, 8. Head, dorsal view.

,, 9. Posterior spiracle of newly hatched larva.

,, 10. Posterior spiracle of fully grown larva.

,, 11. Posterior segments of larva (lateral view).

,, 12. Ventral posterior projection showing fringe of long bristles.

Plate II., Fig. 13. Head of larva (ventral view).
lbr. labrum, *Mn*. mandible, *mp*. maxillary palp, *ep*. epipharynx, *gal*. galea, *hyp*, hypopharynx, *lig*. ligula, *st*. stipes, *sm*. submentum, *me*. mentum, *pc*. epipharyngeal comb.

,, 14. Labrum epipharynx.
lbr. labrum, *ep*. epipharynx, *pc*. epipharyngeal comb.

,, 15. Epipharyngeal comb (highly magnified).

PLATE I.

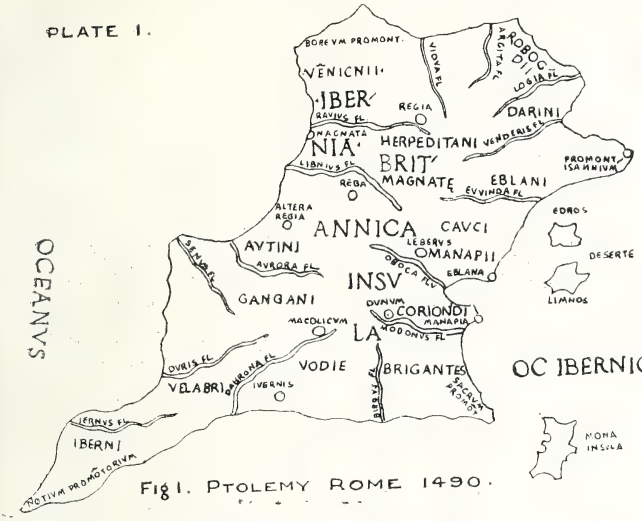


Fig 1. Ptolemy Rome 1490.

SCALE ABOUT $\frac{1}{2}$

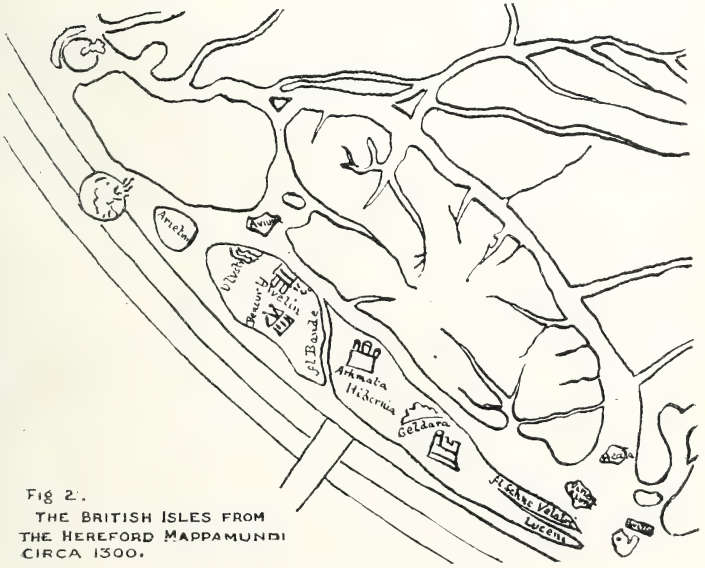


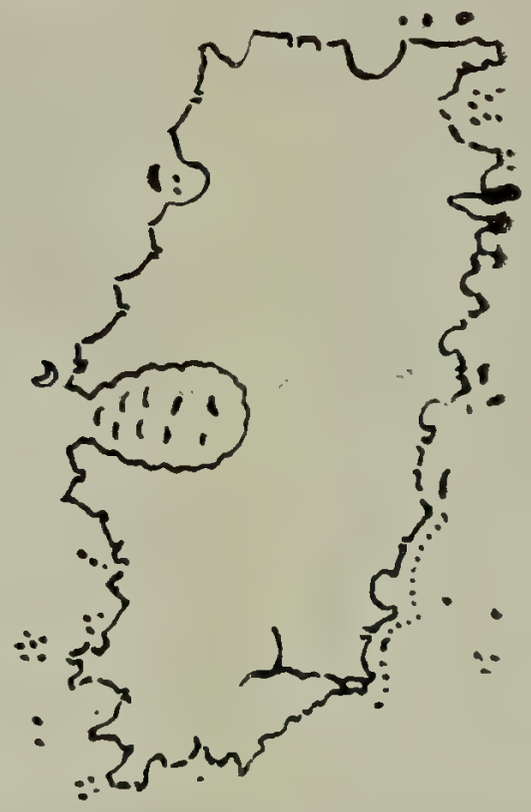
Fig 2.
THE BRITISH ISLES FROM THE HEREFORD MAPPAMUNDI CIRCA 1300.

SCALE ABOUT $\frac{1}{2}$

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

PLATE II. IRELAND IN THE PORTOLAN CHARTS.

TYPE 1. BENINCASA 1468.

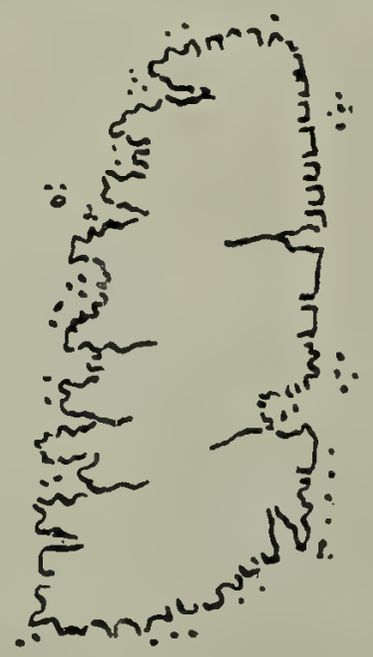


TYPE 2. ANON. circa 1489.

TYPE 3.
ANON. VENETIAN EARLY XVI CENT..

TYPE 4. MARTINES 1583.

TYPE 5. HOMEN 1558



TYPE 6. OLIVES 1614.

BRITISH
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NATURAL
HISTORY.

PLATE III.

The earliest printed Map of Ireland.
Rome (?) circa 1560.
Scale ½

BRITISH
MUSEUM
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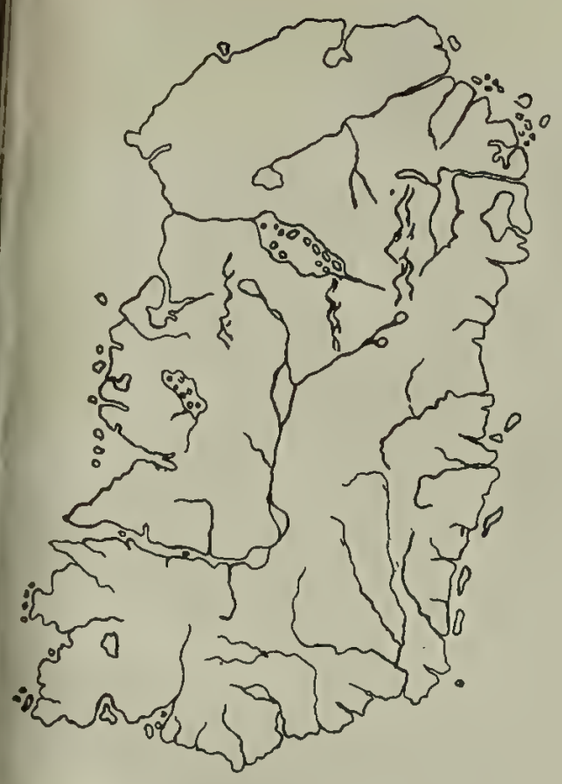
NATURAL
HISTORY.

Porcacchi "L'Isole piu famose del Mondo" Venice, 1572. Size of original.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

PLATE V - PRINTED MAPS OF IRELAND.



TYPE 1. ORTELIUS 1573.

TYPE 2. BOAZIO circa 1578-80

TYPE 3. MERCATOR 1595.

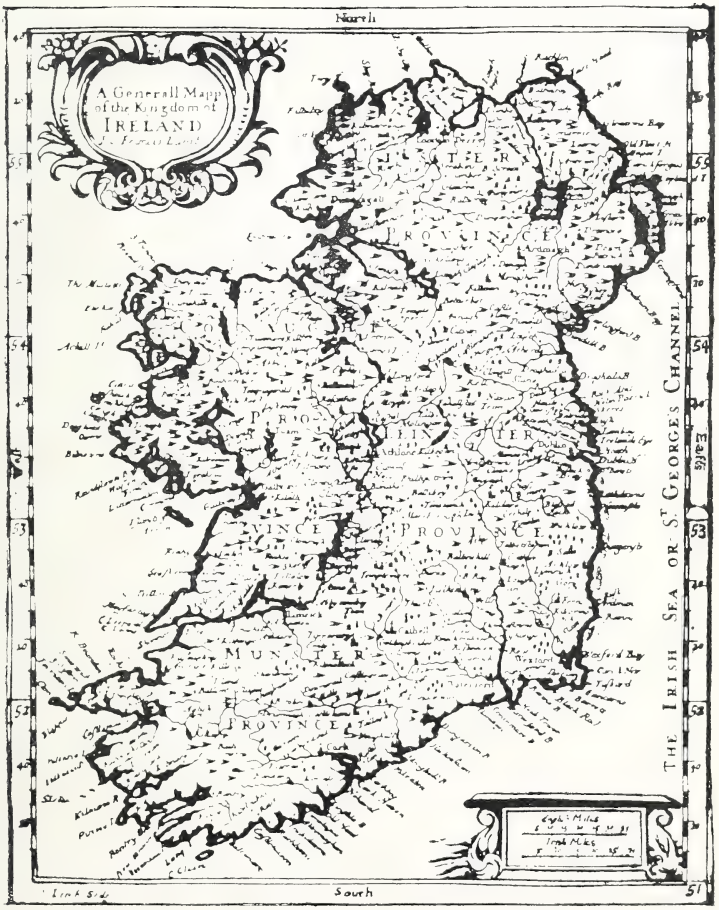
TYPE 4. SPEEDE 1612.

TYPE 5. SANSON 1640.

TYPE 6. COOS 1666.

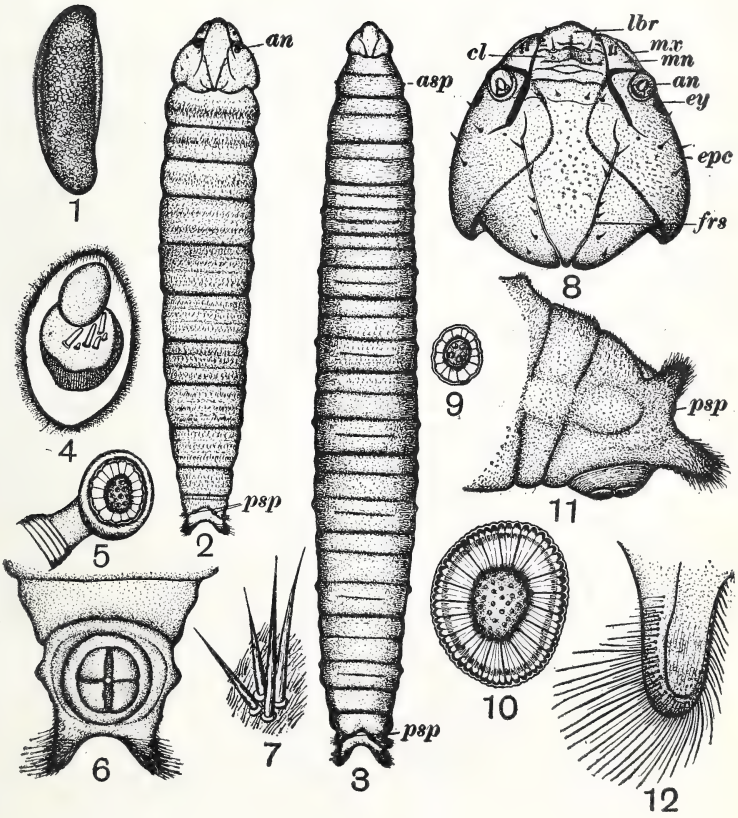
BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

PLATE VI.



Petty's Map of Ireland.
Edition by Francis Lamb, circa 1690.
Scale ½

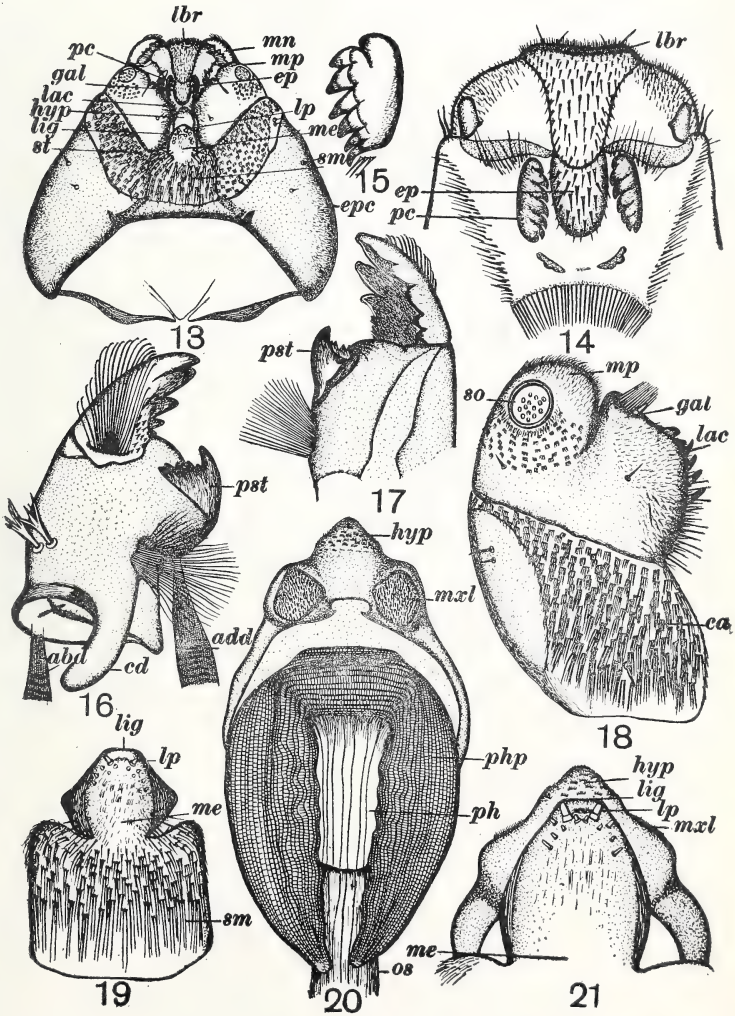
BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.



J.G.R

PLATE I.—TRICHOCERA REGELATIONIS.

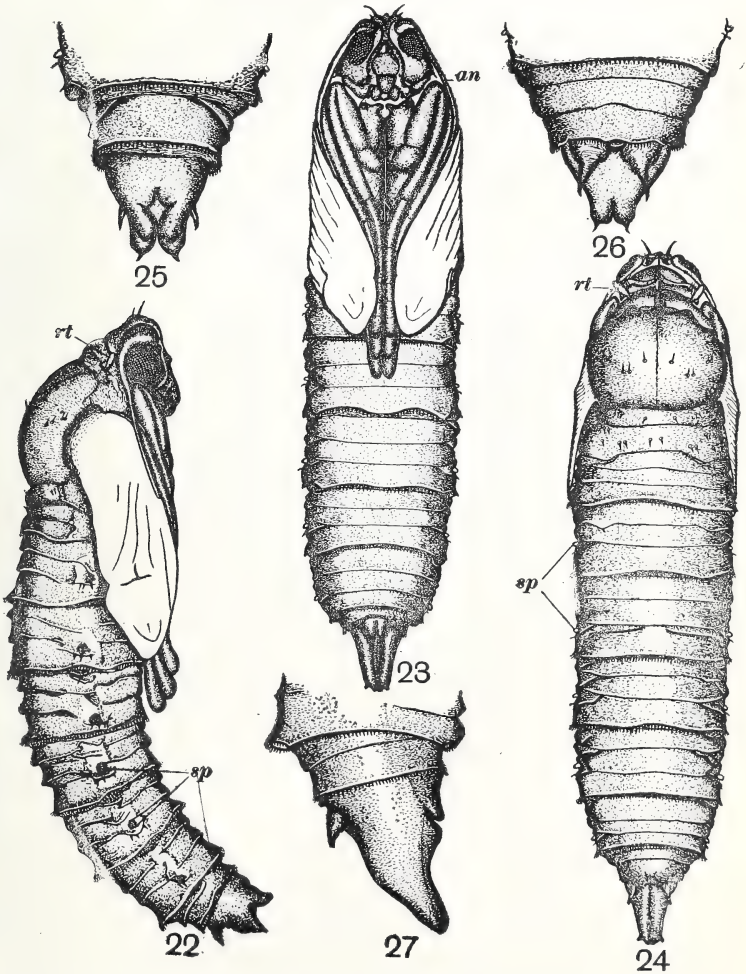
BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.



J.G.R.

PLATE II.—TRICHOCERA REGELATIONIS.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.



J.G.R.

PLATE III.—TRICHOCERA REGELATIONIS.

BRITISH
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23 DEC 24
NATURAL
HISTORY.

Plate II., ,, 16. Mandible.
pst. prostheca, *add*, adductor muscle, *abd.* abductor muscle, *cd.* condyle.

,, 18. Maxilla.
mp. maxillary palp, *so.* sensory organ, *gal.* galea, *lac.* lacinia, *ca*, cardo.

,, 19. Labium.
lig. ligula, *lp.* labial palp, *me.* mentum, *sm.* submentum.

,, 20. Hypopharynx and pharynx (inner view).
hyp. hypopharynx, *php.* pharyngeal plates, *ph.* pharynx, *os.* oesophagus.

,, 21. Ligula and hypopharynx.
hyp. hypopharynx, *lig.* ligula, *lp.* labial palp, *me.* mentum.

Plate III. ,, 22. Male pupa lateral view) *rt.* respiratory trumpet, *sp.* spiracles.

,, 23. Female pupa (ventral view) *an.* antenna.

,, 24. ,, ,, (dorsal view) *rt.* respiratory trumpet, *sp.* spiracles.

,, 25. Male pupa—Ventral view of posterior extremity.

,, 26. Male pupa—Dorsal view of posterior extremity.

,, 27. Female pupa—Lateral view of posterior extremity.

All figures are highly magnified.

ANNUAL MEETING.

102nd SESSION, 1922-23.

The Annual Meeting of the Shareholders and Members for the past session was held in the Museum, College Square North, on the afternoon of the 17th September, 1923.

Professor W. B. Morton, M.A., M.R.I.A., occupied the chair, and among those present were Professor Gregg Wilson, O.B.E., M.A., D.Sc., Ph.D., M.R.I.A.; The Dean of Down; Dr. S. W. Allworthy, M.A., F.G.S.; Messrs. R. M. Young, M.A., M.R.I.A.; F. Adens Heron, D.L., J.P.; R. J. Welch, M.Sc., M.R.I.A.; Ivor Beaumont, A.R.C.A.; T. Edens Osborne, F.R.S.A.I.; E. J. Elliott; H. C. Lawlor, M.R.I.A.; Andrew W. Stewart, F.J.I.; Wm. Faren, F.R.S.A.I.; W. M. Crawford, B.A., F.E.S.; William Nicholl, Alexander Milligan, W. B. Burrowes, F.R.S.A.I. (Hon. Treas.), and Arthur Deane (Hon. Sec.).

Apologies were received from Sir Charles Brett, LL.D.; Sir Frederick Moneypenny, C.V.O., C.B.E., and Dr. Gawin Orr.

The Chairman called upon the Hon. Secretary to read the notice convening the meeting.

The Report of the Council was as follows:—

The Council has pleasure in submitting its Report on the work of the Society during the past session.

OBITUARY.

It is with deep feelings of regret that the Council has to record the loss by death of three honoured members of the Society.

1. Henry Riddell, M.E., M.I.Mech.E., President and Hon. Treasurer, who died suddenly on the 30th January, 1923. Mr. Riddell will be missed by the Society, but only those members who came intimately in touch with him know how much he laboured to advance its interests in any way

he could. A few members felt that they would like to perpetuate Mr. Riddell's association with the Society, and to do this they had a small water-colour portrait of him executed by Mr. Frank M'Kelvey, which they propose to present to the Society. The Subscribers are of opinion that the artist has been very successful in portraying the characteristic features of Mr. Riddell. They now ask the Chairman to accept, on behalf of the Society, this small token of their appreciation.

2. We have also to record the death of Joseph Wright, F.G.S., one of our honorary members, who died on the 7th April, 1923, aged 89. Wright read his first paper before the Society in 1877. He was widely known for his study of carboniferous fossils. A fine collection which he made is now in the British Museum. Later he took up the study of foraminifera, on which he became a world recognised expert. The collection he got together was purchased a few years ago by the National Museum, Dublin.

3. The death of Madame Christen (or Sydney Mary Thompson) at Llandudno on the 16th July, 1923, robs Belfast of a link with the older generations of Belfast naturalists represented by her uncle William Thompson, with G. C. Hyndman and Robert Patterson, F.R.S. She did good work in connection with North of Ireland geology, especially glacial geology, and was one of the foundation members of the Belfast Art Society, for which she acted as Hon. Secretary for many years. An obituary notice by Professor G. A. J. Cole, F.R.S., appears in the " Geological Magazine " for October, 1923 .

NEW HON. TREASURER.

The Council is glad to report that it has been fortunate in securing Mr. W. B. Burrowes, F.R.S.A.I. (for many years a member of the Council) as Hon. Treasurer. Since Mr. Riddell's death the new Hon. Treasurer's task has not been an easy one, but he has taken up the duties with efficiency and enthusiasm, and the Council desires to record its thanks to him for the work he has already accomplished during the past few months. Mr. Burrowes will afterwards submit a report to the meeting.

MEMBERSHIP.

The Council is pleased to state that there has been a steady increase in members under the new subscription scheme of 1914.

It decided unanimously to add the name of Dr. J. S. Crone, J.P., M.R.I.A., President of the Irish Literary Society, and Editor of the *Irish Book Lover* to the list of Honorary Members, the number of these still remaining at seven owing to the death of Joseph Wright.

LECTURES.

While the lectures have not been quite so numerous, being nine compared with eleven given in the previous year, they were well attended on each occasion and much appreciated. The Session commenced on the 10th October, 1922, with a popular lecture given by John J. Ward, F.E.S. who is well-known for his natural history studies. The second part of the Session was opened on the 9th January, 1923, with an illustrated lecture entitled " From the Primitive Drama to Shakespeare," delivered by Percy Allen before an enthusiastic audience. Mr. Allen is a well-known lecturer and author.

The wide sphere of interest in the activities of the Society in dealing with subjects other than purely scientific has been much approved by the members and visitors generally.

While it is the aim of your Council to print a programme of lectures at the commencement of each session, the Council desires to point out that this does not preclude the consideration of original papers submitted during the session, either from members or non-members.

COUNCIL THANKS.

Your Council must express its sincere thanks to all those who assisted to make the closing session a success, and to the local Press for its continued interest in the Society's proceedings.

EXCHANGES.

Important periodicals from Societies and Institutions, both British and foreign, continue to be received. Many of these are of great scientific value, and were inaccessible either to members of the Society or to those of the outside public. It was for this reason that your Council decided that a selection should be made and forwarded on loan to the Queen's University, where they would be classified. This has been done and a receipt has been furnished by the University authorities acknowledging the loan. Members will have free access to it, and it will be returned when required by the Society.

BRITISH ASSOCIATION.

The Council is of opinion that the Society should again become a member of the British Association as in former years in order that it should have an opportunity of being officially represented at the meetings of the Corresponding Societies, and Dr. Allworthy was appointed to represent the Society at the Liverpool meeting.

ARCHAEOLOGICAL SECTION.

A separate report of the work in progress by the Archaeological Section at Nendrum Monastery, Mahee Island, will be submitted by Mr. Lawlor, its Honorary Secretary, at the Annual Meeting of the Section. The Chairman (Sir Charles Brett) and Mr. Lawlor, and those associated with them, deserve the thanks of Ulster for the work which is being carried out on this ancient Celtic monastery.

COUNCIL MEMBERS.

The meeting will be asked to elect five members of the Council in place of five who retire by rotation, namely:— Messrs. W. B. Burrowes, E. J. Elliott, H. C. Lawlor, Wm. Swanston, Prof. Gregg. Wilson.

All these members are eligible for re-election.

HON. TREASURER'S STATEMENT.

The Hon. Treasurer (Mr. W. B. Burrowes) in his report stated that the accounts submitted to the Auditor showed that the Society was indebted to the Bank to the extent of £123 12s 5d. Opposite this the Bank holds as securities 4½ Per Cent. Debentures in York Street Flax Spinning Co., £400, and 5 Per Cent. 1929/47 War Loan, £305 5s 3d. The Balance Sheet, passed by the Auditor of the Local Government Department of the Ministry of Home Affairs, will be found on page 82. It includes the subscriptions and expenses of the Archaeological Section as prescribed by the Department. A separate account of the Section will be seen on page 83. He reported that for this session he had found it convenient to close the accounts on the 31st August, but in future, with the approval of the Council and the Department, he proposed to end the financial year on the 31st October in each year.

ADOPTION OF REPORTS.

The Chairman, in moving the adoption of the Reports, said that his first duty was to accept the portrait of Mr. Riddell on behalf of the Society. It was an excellent likeness, and showed a characteristic expression. The Society was fortunate in having it as a permanent memento of the great services Mr. Riddell had rendered to it and to Belfast generally. It was good to know the old Society was flourishing so well. He was glad to hear the reference to the Queen's University, and that the buried periodicals belonging to the Society had been made available for students and others engaged on research work.

Prof. Gregg Wilson, on seconding, said that he rejoiced at the continued prosperity of the Society, and that the Council had arranged a most excellent programme for the coming year.

Mr. R. M. Young, M.A., said that the portrait of the late Henry Riddell was a most admirable one, and the fact that the signatures of the Subscribers were on the back would prove one of historical interest.

The Reports were unanimously adopted.

ELECTION OF COUNCIL MEMBERS.

On the motion of Mr. Wm. Nicholl, seconded by Mr. Wm. Faren, the following retiring Members were re-elected:—Messrs. W. B. Burrowes, F.R.S.A.I., E. J. Elliott, H. C. Lawlor, M.R.I.A., Wm. Swanston, F.G.S., and Professor Gregg Wilson, D.Sc.

At a Council Meeting subsequently held Professor W. B. Morton, M.A., M.R.I.A., was unanimously elected President of the Society for the coming session; Mr. W. B. Burrowes, F.R.S.A.I., was elected Hon. Treasurer; Mr. R. M. Young, M.A., M.R.I.A., Hon. Librarian, and Arthur Deane, Hon. Secretary.

ARCHAEOLOGICAL SECTION.

ANNUAL MEETING.
1922-23.

The seventh annual general meeting of the Archaeological Section was held at 8 p.m. in the Museum, College Square, on Wednesday evening, 5th December, 1923. In the regretable absence of the Chairman, Sir Charles Brett, owing to indisposition, the Chair was occupied by Mr. Wm. Faren.

Letters of apology were received from Sir Charles Brett, Mr. W. B. Burrowes, the Dean of Down, and others.

The Hon. Treasurer's Report was read, in the absence of the Hon. Treasurer (Mr. Burrowes), by the Hon. Secretary of the Section, who explained that the figures were extracted from the books to show how the finances of the Section stood at the end of its working season, after all accounts had been paid; this was a different date from that on which the accounts of the parent Society were closed, and might show an apparent discrepancy in the figures. The Section had in hand in its ordinary account about £80; when the subscriptions for the new session, which would be collected early in 1924, were paid, this fund would amount, approximately, to £125. The special fund for the work at Nendrum stood at the beginning of 1923 at £129 4s 4d; during the year appeals for subscriptions to the Nendrum fund had brought in £202 12s 3d, totalling £331 16s 7d, which included the sum of £100 voted by the Executive Committee from the ordinary fund to the special fund. The total expenditure at Nendrum, including all miscellaneous expenses, came to £249, leaving a balance in hand for the new season of £82 16s; both sides of the account included a donation of £30 from the Down County Council for the repair of the castle, their property, which sum had almost exactly been expended on that work. Mr. James Lowry had carried out the work as arranged on time-and-cost terms, plus 7½ per cent. for his services, and as the amount spent on the castle exhausted the County Council's grant, Mr. Lowry generously relinquished his commission on this part of the work to save the Section's special fund.

The Hon. Secretary reported that the membership on the roll was now 112. During the season five meetings of the Executive Committee had been held, including a special meeting when Professor R. A. S. Macalister, who came over specially from Edinburgh in April to inspect and advise on the work in progress at Nendrum, delivered a most useful and interesting address; he gave valuable advice as to the best method of persuing the work, and expressed the keenest satisfaction regarding the way everything had already been carried out up to the time of his visit. The Hon. Secretary referred to the balance in hand in the Nendrum fund in the Hon. Treasurer's report, £83 odd; the Marquis of Londonderry had visited Nendrum on several occasions, and hearing that the work was likely to stop for want of funds had generously guaranteed £60; this kind help came at a critical moment in May last, when the fund was down to the last penny; his good example was followed by others, so that money came in. Thus, while the Hon. Treasurer's Report was accurate as to acual money received, the fund, including Lord Londonderry's guarantee, was really £143 odd.

The following office-bearers were elected:—

Chairman: Sir Charles Brett, LL.D.

Hon. Treasurer: Mr. W. B. Burrowes.

Hon. Secretary: Mr. H. C. Lawlor, M.R.I.A.

Executive Committee: The Very Rev. the Dean of Down, M.A.; Major Charles Blakiston Houston; Messrs. R. S. Lepper, M.A.; T. Edens Osborne, J. Theodore Greeves, Robt. J. Welch, M.Sc.; Ingleby Smith; the ex-officio members, under the rules, being Professor W. B. Morton, M.A., President of the Society; Mr. W. B. Burrowes, Hon. Treasurer, and Mr. Arthur Deane, M.R.I.A., Hon. Secretary of the Society.

The Report was adopted, and ordered to be printed in the Proceedings of the Society.

The second list of subscribers to the Nendrum fund will be seen on pages 84-5.

At the conclusion of the business meeting the Hon. Sec. gave a detailed report of the season's work at Nendrum, illustrated by numerous lantern slides. (See pp. 56-81.)

REPORT OF WORK AT NENDRUM, 1923.

By H. C. LAWLOR, M.R.I.A., Hon. Secretary.

Early in March work was resumed under foremanship of James Lowry, jun., and three of the most experienced men who worked with him last year; the experience gained by these men has proved a valuable asset in conducting the investigation; their trained eyes seem to have let no relic, however small, escape notice; they worked steadily, carefully and conscientiously.

During the winter the suggested improvements on the road to Nendrum, referred to in our last report, were carried out. Our Committee voted £10 towards this object, but by arrangement with Mr. Boyd our contribution took the form of labour supplied in widening the road below the ruins to enable cars to turn conveniently, as well as providing room to park the many vehicles of visitors. On the strip of ground given by Mr. Johnston we set back the fence to include this space in the roadway; the cost of the labour somewhat exceeded the £10 voted, but the resultant convenience to visitors has warranted this slight extra outlay. Partly through the representations of our Committee a grant has been passed by the Rural District Council to have the road from the causeway to the ruins macadamised and steam rolled; it is hoped that this will be confirmed by the County Council, and the work carried out during this winter.

The men were engaged on this work for the first few weeks, sometimes two men, and sometimes four; having completed the widening and fencing of the road they resumed the investigation of the foundations of buildings on the north and north east of the second cashel wall, and the section running north from the fence bounding Mr. Clark's bungalow.

From the fence on the top of the hill a straight but irregular raised bank running due east could be traced down almost to the roadway; on examining this and removing the debris, it proved to be the remains of the third or outer cashel wall; the inner and outer facings were fortunately preserved, and the fallen stones were replaced; this wall

proved to be 9 feet in thickness, and the stones in the lower course are in some cases of immense size; there are two breaches in this section of the wall, evidently entrances made at some date subsequent to its original erection; from the fact that there are several substantial field fences close to this it is safe to say that the cashel has been at some time used as a quarry to provide stones for the fences; hence it is practically certain that the original height of the cashel was much greater than what the replaced stones at present make it; we have no evidence to indicate what height this may have been, but at Inismurray the height of the cashel wall is as much as 15 feet in places, and may have been at one time even higher; in this connection it is of interest to refer to Bede's description of the cashel erected by the Hiberno-Celtic monks round their monastery at Lindisfarne on Holy Island, in Northumberland, which was of such a height that from nowhere inside it could the brethren see anything but the heavens above them.

Towards the east end this wall disappears, and it is impossible now to say how far it extended in this direction; but behind the tea house may be seen fragments of a wall running at right angles; if our investigations continue, much may yet be laid bare in this direction.

Persuing the third cashel westward we find that west of the modern fence running N. and S. on the summit of the island the land has been under cultivation, and practically all trace of the cashel removed; the stones of which the cashel consisted may be seen in heaps on the adjacent rocky shore; the site of the wall can be indistinctly traced on the ground, but the stones that it consisted of are almost entirely gone for several hundred yards, where the land was at one time under cultivation. However, Major C. Blakiston Houston, who came down to his bungalow in May, determined to trace this wall so far as possible in detail, and by following the contour of the ground succeeded in finding fragments of the foundations. Where found these have been left exposed. Opposite the old quay on the west shore of the Island and in a direct line between it and the west gate of the second cashel he discovered the site of the gate of the outer cashel; this was seven feet wide; on the north side of the gate, abutting on the inside face of the cashel, appears to have been a small oval chamber, measuring $8\frac{1}{2}$ by $3\frac{1}{2}$ feet; this was undoubtedly a cell for a janitor.

From the thickness of this wall its height originally was probably considerable. There was a complete absence of any sign of foundations of bastions or gate towers.

Thirty yards to the north of this gate, inside the cashel, may be traced in the grass a circular saucer-shaped depression; a few stones sunk in the ground here and there in this circle seem to indicate that some buildings of important dimensions existed here at one time, but it was impossible to form any idea as to their character. Pottery fragments of the early or souterrain type were found here in some quantity, but none of these could be pieced together; there was not much appearance of sooty soil, so that it would not be safe to assert that this site was for any long time occupied as a dwelling place; a number of nails were also found, but the nature of this building cannot now be safely conjectured; if the pottery fragments are contemporary with the building, whatever it may have been, they would indicate probably the seventh century or earlier.

South of the west gate the investigation of the outer cashel was not persued; it seems to continue into the mass of thorn and bramble bushes near at hand; the ground where this thicket exists has never been cultivated or apparently interfered with since the monastery fell into ruin, and if investigations were proceeded with in this direction fruitful results would probably reward them; but the funds in sight did not warrant our undertaking so great a work as this would entail.

At the same time as some of the men were working on the outer cashel on its west side others were laying bare the foundations between the second and third cashels on the N. and N.E., and some fragments of walls outside the third cashel; these foundations are shown on the plan prepared by Messrs. Blackwood and Jury; they are, to say the least of it, exceedingly puzzling; for the most part they are about two to three feet in thickness, and mostly of great irregularity in shape; one, however, is quite straight, and continues for no less than 100 yards, appearing in a fragmentary condition inside the second cashel, as if the cashel had been built on top of it, and was, therefore, later in date. It is usual to attribute circular cashel forts to pre-Christian times, though undoubtedly the early Hiberno-Celtic monks in some cases erected them to enclose their

monasteries as late as the sixth or seventh centuries; many instances are, however, known where the Christian converts established themselves in previously founded pagan raths or stone cashels (e.g., Armagh and Downpatrick).

In Nendrum we have the story of MacCuill MacGreccae as a chief of an established community here in Saint Patrick's time, recorded most fully in Muirchu's Life of the Saint; but the fact is not mentioned specifically that MacCuill's settlement consisted of rath, like Daire's of Armagh.

Unfortunately during the whole course of our investigations at Nendrum we cannot point out any positive evidence pro or con that the cashel walls are of date subsequent to the Christian foundation, or on the other hand, that they are not. As will be referred to later, we have proof that at an early period, almost certainly prior to the eighth century, the whole site between the inner and second cashels was completely altered and the enclosure made by the second cashel, raised to the form of a terrace, on the surface of which were erected bulidings in which a busy hive of industry existed; I am, however, anticipating.

Unless further investigation takes place, and further evidence results therefrom, it would be unsafe to say more than that it is most probable that the cashels, of which the present repaired forms cannot be said to represent with any degree of certainty their original height, are the remains of the pre-Christian settlement known to have existed here, and that the ancient fragmentary foundations referred to, are older still.

Among these irregular foundations was a mound some 30 feet in diameter and rising in the centre to about 5 feet (14 in plan); on investigation this proved to be a round building 9 feet in diameter, with a narrow door on the north side. Two built drains in a straight line lead from the building to the outside; the masonry, dry built, is faced on the inside only, the outside being supported by earth piled against it. No relics were found in this site; what remains of the circular wall averages about four feet high, but there is nothing from which its original height can be conjectured. On the floor were slight traces of burned lime and charcoal, and it has been suggested that the building was a lime kiln used by the masons who built the round tower; but the stones showed

no trace of vitrification as they would have had this been the case; it is more probable that this is the cell of a solitary monk or anchorite; its present height is probably almost as it originally existed, the roof having been conical and of thatch.

The only relics found among these foundations of walls were fragments of pottery of all the periods from prehistoric or souterrain type to late mediæval, and one bronze pin similar to one found later in the hut sites on the west side. (No. 83.)

During May and June the men also devoted attention to the ruins on the east side; at the end of the previous season the existence of a gate had been discovered in the inner cashel; it had suffered a good deal of damage by the removal of stones; by very careful examination, however, we were enabled to trace the outline of this gate and to restore it with almost complete certainty to something of its original design. The entrance is narrow and runs diagonally through the cashel; remains of a stone wall run alongside on the inner side as if for defending the entrance in case of attack; the clay floor of this gateway was beaten hard by the feet of many generations of those using it, and the hard brick-like path continues eastward for several yards, when it develops into a walled causeway leading over the top of the second cashel. On the outer or eastern face of this cashel the causeway had acted as a buttress to the cashel, thus preserving it from falling out at this point.

This eastern gateway was undoubtedly the well gate, and the raised causeway leading from it in the direction of the monk's well was unquestionably erected at a later period than the cashels themselves; if the causeway to the well were erected, as it probably was, by the early Christian monks for their convenience in their peaceful avocation, it would indicate that possibly it may date from as early as the establishment of the Christian monastery in the fifth century. We know that the pagan chief MacCuill was a bandit and robber of the worst character; his hand was against every man and every man's hand against him; it may well be assumed that the massive fortifications were with him a necessity of the first magnitude. Not so with the peaceful monks, and the erection of the causeway leading to the well did away with the usefulness of the cashel wall here as means of defence, this being no longer necessary.

To the north and south of the buttress formed by the causeway the second cashel had been prostrated outward by sheer pressure of the soil piled within it, and deep excavation was necessary to trace it; all the foundations, and in several places several tiers of masonry remained in situ, and after clearing away the debris this wall was replaced in its original position, from Mr. Clark's fence northward to the point where we left off at last season. Thus, except for the portion of the second cashel occupied by Mr. Clark's and Major Blakiston Houston's bungalows, the second cashel has been repaired to its whole extent, except for three short gaps where it had been entirely removed for agricultural purposes. In excavating on the east side, near the causeway, a curious wall facing westward was found; this runs parallel with the eastern facing of the second cashel, 15 feet distant; it looks as if this were the inner face of the cashel itself; but if so the cashel would have been 15 feet thick at this section. There is considerable difficulty in coming to a conclusion on this point, however; the difficulty is added to by the finding of the foundations of yet another wall of huge stones, apparently of very ancient date, facing east, right up against this supposed inside face of the cashel. Visitors to the place can see these several fragments of walls and possibly arrive at a solution which has not presented itself up to the present.

At the N.W. of the second cashel, where a section has at some time been removed in preparing the ground for tillage, we found, on excavating, portions of the foundations, and it is worthy of note that, like the inner cashel, the second cashel at this point protruded into the form of a cusp. As mentioned in last year's report this peculiarity is also found in the cashel at Inismurray; no apparent reason for the cuspidation of the cashels in either place has been adduced; the outer or third cashel has been entirely removed at the N.W., so that it is impossible to say if it also was cuspidated.

As will be seen on the plan, a thin wall runs almost parallel to the third cashel on the north side, about 12 feet to the outside; this wall resembles those inside the third cashel; it is about 30 inches wide, and is joined on to the cashel by a cross wall; we have nothing to guide us as to the original height of either this narrow wall or the cashel itself. On the 17th of May, in the angle of the cross wall,

the men discovered an ecclesiastical bell; it was sitting mouth downwards, buried partly in the soil and partly by stones fallen from the cashel. When found it was so corroded and filled and covered with earth made hard by mixture of rust that it was not at first recognised as a bell; of the handle only a stump remained. After steeping the "find" in water to soften the attached soil, the men scraped a good deal of it off; it was brought up to the Museum in Belfast, where it received scientific treatment by which the encrustation of rust was entirely removed. Unfortunately it was found that in the efforts to remove the rust a flake of the bronze surface had split off; otherwise the bell is in excellent preservation, and the bronze surface can now be clearly seen. The site where it was found was afterwards carefully turned over and riddled, with the result that a portion of the handle was found; a small section is still missing. See Plate II.

The bell is 9 inches high to top of handle; like all the other early ecclesiastical bells it is quadrilateral, and measures $5\frac{1}{2}$ inches x $4\frac{1}{2}$ inches at the bottom narrowing towards the summit; there was no clapper, but the hook to which the clapper had been attached remains; it is of wrought iron, made apparently in one piece, rivetted on one side; it had been dipped in molten bronze, which in parts remains quite thick. Whether the handle was originally forged as part of the structure, or afterwards joined on, cannot clearly be seen; if all were hammered out in a piece, including the handle, it is certaily a marvellous achievement of a smith, which would be hard to equal to-day. Comparing this bell with the famous bell of Saint Patrick, whose history the late Dr. Reeves so carefully tabulated, one is forced to believe that they are contemporaneous. The shrine of St. Patrick's bell is of extreme beauty, and its workmanship so extraordinary, that it usually makes one almost forget the actual bell itself; the shrine is, however, the work of the early 12th century, the bell, of the fifth. Saint Patrick attached great importance to the equipment of the presbyters and bishops whom he ordained, with bells, croziers, and other implements for use in their holy calling; in his retinue were no less than six artificers in metals whose names are preserved to us, three smiths and three braziers, of whom Saint Tassach of Raholp was one.

With a spontaneous generosity and patriotic instinct, which unfortunately is rarely met with, Mr. Johnston, the proprietor of Nendrum, and his son, Mr Alec. Johnston, decided that so precious a relic of the ancient Irish Church should not remain in private hands, and presented it to the Society's collection, where it now remains in a specially made glass case. It is worthy of note that the bell of Nendrum, of all the sacred bells preserved in the collections in the museums of the Royal Irish Academy and our Municipal Museum, is probably the only one untainted with filthy lucre; they have all been traded with, bought and sold each time by hucksters at a profit. The bell of Nendrum stands alone, untainted, a holy relic which has never passed through "a house of merchandise."

In June the men were put to make a careful examination of the fragments of building which had been to some extent laid bare immediately inside the west gate of the second cashel.

Those who have visited the place will have noticed that the second cashel, after the debris had been cleared on the outside face and the fallen stones replaced, appears in the form of a terrace, almost flat on the top. At a certain spot marked A in the plan a broken iron cooking vessel or frying pan was found behind the outer face of the cashel, about 30 inches above the outside ground level and three feet below the surface of the inside upper level; this vessel was sitting in the remains of a fire, and its position inside the wall seemed to convey that it was buried in the course of building the cashel. The vessel is evidently one known as a sartago; they are referred to in Adamnan's Life of St. Columba as in use at Iona.

Professor Macalister carefully examined this pot, and expressed his opinion that it could not be set down to a very early or prehistoric date, almost certainly not prior to the fifth century, when, so far as our knowledge goes, a decided advance in the skill of metal workers became apparent in Ireland, due probably to the work of Saint Patrick's artificers. If he was correct in this opinion, and if the position of the vessel with regard to the cashel indicated, as it at first seemed to do, that the cashel was erected while the vessel was there, it would appear as if the cashel might thus be approximately dated as contemporary with or

later than the age of the vessel. Realising the importance of this clue, the site of the vessel was again laid bare from the inside, and to our surprise we found that the cashel was faced inside as well as outside, the inner facing having been entirely buried when the cashel was converted into terrace form. The inner facing at this spot was only about 30 to 36 inches high from the inner original ground level; the vessel lay on what had at one time been a level surface exactly half way between the inner and outer facings; it had been evidently buried when the terrace was made. The accompanying rough sketch of a section, showing the position of the vessel as compared with the cashel and terrace will explain the case perhaps better than a written description, or at least amplify the description (Pl. III).

From the above, assuming that the vessel belongs to a period between the fifth and eighth centuries, which is extremely probable, we come to the conclusions, that the terrace was made at some time during that period; that in making the terrace, the original cashel was buried on its inside facing; that when the terrace was formed by filling in, the cashel was at this place, only about three feet in height and probably dilapidated, having fallen into ruin; that when the terrace was made, the outside facing was repaired to retain the filling in material of which it was formed, and that what remained of the inside facing was buried.

Thus we have another indication, it cannot be called proof, that the cashels were part of the pre-Christian settlement which certainly existed on this site, and much older than the terrace on which the circular buildings were afterwards found.

A passage in the Lives of the Saints of Ireland, quoted in several editions, may throw some light upon the matter; in the life of Saint Colman of Dromore, dealing with his boyhood days at Nendrum, a reference is made to a miracle he is said to have performed on "the path by which the brethren come to matins." This paved path has been laid bare, leading from the church door in a semi-circular form inside the inner cashel, out by the southern entrance of that cashel to the open space between the inner and second cashels. From this it would appear that in this open space were the cells of the monks, or at least a number of

them, as some of the monks, such as the fishermen, the boat builders, etc., may have had their cells near the south quay, which remains in use to the present time.

This clue to the site of the cells of the monks has had extraordinary confirmation in the discoveries made during July, August, and September, while the men were investigating the space between the inner and second cashels from the N.W. to the S. In the plan prepared by Mr. Jury and his son, Mr. A. Jury, and Mr. Armstrong, the places excavated are marked with small dots, and the outlines of ancient buildings are defined.

While some of the men were investigating the spot where the sartago was found, with such important results, others were engaged in laying bare the site immediately inside the west gate. Last year we had exposed part of the foundations of two dry built walls of crescent shape, so closely situated to the gateway as to suggest that they were built as defences to exclude intruders by the gate from entering in more than single file. From their position at the gate they appeared at first sight to be janitor's cells, from which such defence could be made.

Professor Macalister, when visiting Nendrum in April, 1923, gave much attention to the gate and these contiguous buildings, then only partially exposed. He pointed out that they were on a completely different level from that of the original cashel, and could not fall in with the suggestion that they were at all contemporary with the cashel, or formed part of any defences of the original structure.

The excavations which took place during June and the following months entirely confirmed Professor Macalister's view, as well as supporting the conclusion arrived at from the reference in the Life of St. Colman, that the cells of the monks were situated on the broad level space between the inner and second cashels, from the west to the south.

Gradually and carefully the men proceeded to remove the top soil inside the west gate; the crescent-shaped walls exposed last season, extended into circular foundations of ancient buildings. North and south of these, more circular or oval foundations were laid bare, with a number of fragments of walls of somewhat irregular and uncertain design; north of the row of circular foundations, five in number, was a rectangular building, orientated similarly to the church,

with its western wall standing on the edge of the cashel. The walls of this building were of stone, cemented with puddle clay, in a manner characteristic of the Church of Raholp before its "restoration"; the foundations of the circular buildings were dry built. North of the rectangular building were traces of another rectangular building, the end wall of which was built on the outer face of the cashel; of this building, which was also clay cemented, little else but the end wall and a fragment of the opposite one could be traced; in the floor at the north end is a curious rectangular hole some 20 x 18 inches, built of dressed stones; its purpose is unknown.

Examination of the soil on which all these buildings sit showed that it was all filled-in material; everywhere were found traces of midden remains, beef bones, oyster, scallop, and limpet shells, and fragments of pottery of the early or souterrain type. Wherever it could be done without disturbing the surface buildings, excavations were made in this midden deposit, and a careful note made of the various articles found. Every effort was made to keep the articles belonging to the filling in refuse separate from those belonging properly to the surface buildings themselves, but this was impossible to do with complete accuracy. The whole site where the circular buildings lay has been levelled for cultivation, and neither the precise floor levels inside the foundations nor the levels of the ground outside them, as they lay before the levelling, could be precisely defined.

The most notable fact in these excavations between the surface buildings was that remains of walls were found several feet down, and that the surface buildings were superimposed on remains of older buildings which had been buried up by the conglomeration of kitchen midden refuse and soil used in converting the site enclosed by the second cashel into a raised terrace. To investigate thoroughly these fragmentary buildings on the lower level, would have involved the destruction of the surface buildings and the removal of some thousands of tons of the filling-in material, which, had it been practicable or even likely to produce valuable results, would have been sacrilege. In the somewhat limited spaces between the surface buildings where there was room to go down to the till, enough was exposed to show that these fragmentary buildings resembled those exposed on the N. and N.E., between the second and third cashels;

they seemed to follow no discernible design. Probably the greater part of them had been removed before the terrace was made. The only building of the lower level which remained in any way perfect was found under the south wall of the rectangular building already alluded to, marked on the plan as "The School" (No. 22); this is a small circular erection resembling possibly an oven or sweathouse; it is of very rough type of building, faced only on the inside; it is 51 inches in diameter, 72 inches from the till on which it is built to where apparently was the apex of the beehive roof. What this curious structure was it seems impossible to conjecture; it was filled with the usual mixture of midden refuse, and at the bottom contained a good deal of black sooty soil. It has been left as discovered, but as it was dangerous for cattle, resembling an ancient well hole, it has been covered with beams laid across it a few inches apart, so that it can be inspected by visitors but not injured by cattle, or, on the other hand, do injury to them.

Of all the surface buildings on the west and south west, inside the second cashel, it is important to note that the whole site had been at some time subjected to cultivation, from the building marked "school," southward. The school apparently lay untouched, except that the walls had been removed down to within a foot or two of their foundations; apparently the debris of the ruin inside the walls lay undisturbed. The investigation seemed to show that all the buildings in this area had been burned, and that in the school, where the site had not been cultivated, the remains lay practically as left after the fire. The fact of the ground having been under cultivation rendered it very difficult to reconstruct mentally the appearance of these buildings prior to their being levelled. We have a guide in the fact that the bottom of the foundations of the oval and circular buildings were on an average 18 to 24 inches below the level of the surface as it lay before our work commenced .

From what is known of primitive dwellings in raths, and from a sketch in the Bayeux Tapestry, the ordinary dwelling of the native Briton and of the Irish rath dweller of the period preceding the Norman conquest of England was a circular building constructed of wattles and mud, topped with a roof of thatch. They were erected on low platforms enclosed by rough walls of dry built stones. In the rare cases where these can now be found undisturbed

the circular platform remains with the decayed or burned remains of the dwelling lying in the form of a flat conical mound, under which may be found such relics of the ancient occupants as have survived the destruction of time.

From the appearance of the circular and oval foundations as now exposed it is quite evident that prior to the time when the site was levelled for cultivation, these buildings appeared as circular mounds, enclosed by the still existing stone facings. The farmer naturally turned the summits of these mounds over on to the hollow spaces between them to obtain a flat surface for the plough. This was, in fact, the condition of the site disclosed by the excavations. It will thus be realised that it was impossible to discriminate with any degree of certainty, in some instances, whether the relics found belonged properly to the surface buildings, or to the midden refuse on which they were built.

Of the more important relics a detailed account has been preserved. Commencing with the fragments of buildings marked 15 on plan (between 17 and 34), these appear to belong to the lower and older erections; they are most peculiar in appearance and difficult to understand; they have been left exposed as found, so far as safety to cattle would permit. The only relics found here were a bronze ring pin with broken top, a large fish-hook (?) (Nos. 80 and 73), both near the surface, and the usual collection of miscellaneous pottery of the souterrain type, lower down.

The circular buildings north of these, numbered 17 to 20 in the plan, proved rich in finds of absorbing interest and importance. Immediately outside No. 17, on the south side, at a low level, was found a small rectangular stone (No. 116) measurng $1\frac{1}{2}$ x 3-16 inches; it is pierced at one end, as if suspended as a personal adornment or charm; or it would serve as a sinker for a fishing line; on three sides it is ornamented with interlaced pattern, and on the fourth side by a score down the centre, from which small cross scores protrude, having all the appearance of ogam writing; if it is ogam, it does not appear to tally exactly with any of the ogam examples given in the Auraicept Na n'Eces, or scholar's primer, in the Book of Ballymote. Information is being sought for, however, from competent authorities, and a solution of the problem

may yet be forthcoming. Two bronze pins, one with pierced head with double ring, and one with head resembling a countersinking drill were found in the soil thrown off this building, together with nails and other much corroded fragments of iron, and a small bronze object engraved with a Celtic cross and interlaced design (Nos. 82, 83, 86).

In No. 18, besides the usual collection of pottery, iron nails, etc., were found one celt of rather soft light-coloured stone, and what appears to be a similar implement of iron (Nos. 37, 78a).

The building marked No. 19 proved of absorbing interest. Fragments of probably as many as forty crucibles for melting bronze were found either inside the foundations or immediately outside; five were perfect, and a number of others can be pierced together to a greater or less extent. They were of various sizes from one inch to nearly four inches across the mouth. They were all roughly triangular, one angle being elongated as a stroup from which the molten metal was poured. They were made from some kind of fire-clay, and the surface displayed a beautiful metallic glaze in colours varying from greenish gray to bright red, caused by vitrification with molten metal; in a number of them bronze still adhered. Three holders for the crucibles were found; these consisted of small quartz boulders about four to five inches in diameter, hollowed out on one side into triangular receptacles to fit the crucibles; they also were covered with traces of bronze and highly coloured with metallic glaze (Nos. 93-101). The tools found consisted of iron knives, small polishing stones, and a pair of iron pliers. In the soil in close proximity to the outside of the foundation the larger of the two penannular brooches was found (No. 84) with elaborate ornamentation and holes for two jewels; the pin, with beautiful patina, was broken, so that its length cannot be estimated. A stone with five moulds for casting pin heads or buttons was also found (No. 20), and two of the pins found in other places seemed to fit one of the moulds in this stone; two other stones with similar moulds were also found in other places. In the soil were innumerable little nodules of bronze, droppings from the crucibles. The next circular building, No. 20, was barren of relics, except for pottery fragments and numerous large iron nails, which were found in all of these sites. Between this and the school, no remains of surface buildings were found, though

low down, next the till, were signs of irregular buildings so incomplete and confused as to appear meaningless; these were covered up again.

Next we came to the rectangular stone and clay building marked " School." This site had not been tilled; when first seen it was overgrown with a very luxurious crop of nettles, a weed which was not remarkably prevalent except in this neighbourhood, and, of course, the ubiquitous bramble. On clearing the overgrowth the outlines of the foundations were clearly discernable; inside these was a low heap of charred rubbish, evidently lying in position as left after a fire, of which there were evidences in all the building sites excavated; only on this site the remains lay undisturbed.

The men carefully proceeded to remove the debris; it was of black vegetable soil; here and there were exposed the remains of much charred beams, with numerous large iron nails; the charred beams crumbled to pieces on exposure; these were evidenty the roof beams lying in burned thatch. In Adamnan's Life of S. Columba are references to similar beams; also to the lock and key of one of the buildings at Iona; at Nendrum no remains of locks or keys were found, but in the school was found a large iron ring attached to a square pin (No. 76), which was evidently the door handle working a clip; it was lying adjacent to the doorway, with one of the hinges and numerous iron nails. Below this debris, where the floor level evidently was, were found what apparently justifies one in calling this building the school. Numerous small tablets (Nos. 103-115) of slate or stone lay under the debris, each one with inscribed designs and patterns; only two had Celtic letters; in several the pattern had been inscribed on the top of the little tablet, as in a headline of a modern copy book, by the instructor, while underneath this were the attempts of the scholars. Adamnan refers to tablets of this description at Iona as " tabulae "; some of them at Iona, as well as at Nendrum, were made of wax. Several examples of similar stones, " trial-pieces," they have been called, are preserved in the museum of the Royal Irish Academy; they were from crannogs, and are attributed by the museum authorities, without much data to go on, to the seventh century. Fifteen rough bone beads, cut apparently from the shanks of sheep or deer, lay scattered within a space of about a yard

in diameter; some of these were just as sawn off the bone; two had tiny iron pins in them, as if some ornament had been rivetted on; one was neatly carved with a triquetra, a design that also appeared on two of the tablets (Nos. 122-132). In close proximity to these beads were found the remains of a skeleton, which Professor Walmsley thinks to be that of a man of about 25 years of age, of slender build.

The men jumped to the conclusion that the beads had formed a necklace worn by the deceased; but this does not seem probable, as some of the beads were just as cut off the bone and not pierced, others being finished, the collection being evidently the half finished work of a scholar. Unfortunately the men had not noted very carefully the exact relative positions of the human bones and the beads; on making exhaustive enquiry afterwards from the men, it seems that the skeleton was about eighteen inches below the probable surface of the floor. The interment of this body may have taken place before the building of the school or after it had become a ruin; no indication on this point presented itself unless the probability that if the interment was subsequent to the fire, the beads would have been scattered, and the strata disturbed, which they were not.

Another bone, apparently the handle of a knife, a good deal polished by use in the hand, was found; it was ornamented with a roughly carved head of a duck or seagull (No. 112); immediately outside, near the east gable, was found a small penannular brooch (No. 85).

Of tools or implements, the most important were four styles, all more or less injured (Nos. 40-43), by rust; they were of iron, 5 inches in length, pointed at one end, flattened at the other to lie against the side of the knuckle of the first finger of the scholar's hand; the reason for this flat end is naturally to ease the pressure necessary for scribing on stone. Of these, No. 42 is of particular importance. In the British Museum are shown Roman styles of bronze, exactly similar to this one. The straight edge at the upper end was used for deleting characters on wax tablets, one of which is preserved there. This seems to prove that the scholars at Nendrum, like those at Iona, had wax tablets as well as slates. Two of these early Irish wax tablets, and one wax book are preserved in the collection of the Royal Irish Academy. Adamnan refers to these

styles as in use at Iona, and calls them graphia; graphium is also translated a pen, but as an instrument for engraving it more strictly applies to such instruments as referred to here. When speaking of pens as we use the word, Adamnan uses the word calami; these were made from reeds, quills, or canes; all such had, of course, long disappeared. A number of knife blades were found, all in a much corroded state, which had evidently been used by the scholars for carving, and two bronze needles of small size, one broken off at the eye, the other perfect (No. 75).

This extraordinary find of the remains of a school is of the utmost importance, probably unique in Celtic archaeology. Two things must be borne in mind; the fire had evidently destroyed everything of an inflammable nature in the place; if anything organic escaped the fire, time and decay had destroyed it. The second thing to be remembered is that in early days paper was unknown, and parchment too rare an article for scholars to waste; the alternatives to paper or parchment were naturally slate, bone or wax tabulae, and without chalk, the natural means of inscribing were metal styles. Although only four recognisible examples of the styles were preserved, there were many small pieces of iron corroded beyond recognition, which were probably similar implements. Possibly the more advanced scholars were permitted to use parchment with ink and colouring fluids with calami or possibly quills and brushes; but all sign of such had naturally disappeared between fire and decay. From the number of pointed iron knives which survived, we may safely assume that a lot of scribing and carving was done on wood and bone, a few examples of the latter surviving. Compasses were used, and one arm of a compass survived (No. 72).

Studying these inscribed tablets and bones as a whole, what appears to be the most remarkable feature is that on only two (possibly three) out of about thirty is there any sign of lettering; on one tablet only are several well formed Celtic letters, on another, among other apparently unimportant scratchings, appears the solitary letter M in runic of the same type as this letter in the old Norse stone described in last year's report. This solitary letter, quite distinct, though possibly accidental, may guide us as to the date of the school being subsequent to the first invasion of the Norsemen.

It is a very remarkable fact that of all the stones displaying carving, such as the numerous crosses, the fragments of the sun-dial and the many tablets of the school, over forty articles altogether, three only, possibly four, bear any trace of the use of letters; of these, the fragment of the Norse stone can hardly be earlier than the eleventh century; the tablet showing the somewhat doubtful runic letter M is unlikely to be very much older; so that of purely Celtic lettering we have only two examples.

Going further afield, it is an equally remarkable fact that in the whole of Uladh, i.e. the territory corresponding approximately to the present United Diocese of Down and Connor and Dromore, only two grave stones have been found bearing inscriptions in Celtic lettering, of which, in neither case, have we indications as to date.

One is thus forced to the conclusion, failing evidence to the contrary, that in the centuries immediately following the introduction of Christianity into Ireland the art of writing may not have been as generally acquired or as widely taught in the schools as is usually supposed. Of course, we know that such early saints as SS. Finian and Columba were fluent writers; the former was a pupil of Saint Colman of Dromore, who graduated at Nendrum; but both these eminent saints travelled far in Europe after their preparatory education, before their fluency in writing became a matter of history. It is noteworthy that in the early Hiberno-Celtic monastery the scribe or writer was an important official; possibly the scribe was sometimes the only person in the monastry who could write.

That only two of the tablets found in the school, and none of the other carved crosses, etc., found elsewhere, except the Norse stone in the church ruin, showed signs of Celtic letters is a fact of immense archaeological importance; it is one that opens a question of far greater scope than can be answered or even discussed at any length in this report. All the tablets except two were found in or in the immediate vicinity of the school; of the two exceptions, one was found last year in the midden refuse N. of the second cashel; the other, east of the church almost on the surface of the ground; they are evidently akin to those in the school, and are included with them.

The question of the disposal of the crosses, all of the slab type, was discussed in last year's report; suffice it to say that all these, except the lost one described and depicted by the late Mr. W. H. Patterson, have been inserted in the east face of the west gable; they are twelve in number, including fragments.

Of the sun dial, the base of the pillar and the greater part of the dial were found lying south of the west gable; another fragment of the dial was dug up near the monk's pathway; of the pillar, between the base and the dial, eight small fragments were turned up in various places, one buried 18 inches deep, west of the west door, another, which joined on to it, in the debris of the inner cashel; most of the small pieces of the pillar that were found, fitted together, but the sum total of fragments of the pillar unfortunately do not convey any very lucid idea of its original appearance. It is of local stone, resembling basalt or whinstone; the pattern on the face was of beading in fairly high relief; on what remains of the side is a beautiful design of interlaced swasticas. Of the original height of the monument no indication remains; the base measures $13\frac{1}{2}$ x 6 inches in section, and from the bottom to where broken off is 14 inches; a few inches of the frontal beaded carving remain below the fracture. The dial is $15\frac{1}{2}$ inches across; most of the side carving of this is gone; the hole for the gnomen is circular, and at right angles to the face, so that the gnomen was evidently a crude round-pointed pin, not triangular as in more modern sundials. A bronze gnomen of the type indicated has been inserted.

The question of the partial restoration of this monument naturally presented great difficulty. The base and dial were fairly perfect; of the intermediate pillar only a few fragments were found; where they could be they were joined together, and all cast into a concrete pillar in which there can be no confusion between the original carving and the concrete. This pillar is 6 feet 3 inches over all, from bottom to top; it is cemented against the southern end of the west gable, facing 23° W. of due magnetic South. If at any future time more fragments are discovered, the concrete can be broken up and the newly found fragments re-inserted in a new pillar. Its present position, supported by a rough extension of the gable, was chosen for preservative reasons; erected as an isolated pillar as it originally was, it would have been certain to have suffered by cattle.

As will be seen by the illustration, Plate III., the dial has no figures; noon is correctly represented by the shadow at 12 o'clock true Irish time, on the almost perpendicular line. At the uncertain period when this sundial was erected, unfortunately no knowledge of the current division of time is at the disposal of anyone who has, up to the present, examined the sundial; possibly this may meet the eye of someone more learned in chronology than anyone who has yet seen it; if so he may, from its design, be able to date it accurately, and tell us something of the correct horology of its period.

This report would be incomplete without a reference to the fictilia found during the excavations; it may be said that pot fragments were found everywhere that excavation took place.

The pottery may be divided into three types, as follows:—

A. Rough hand-made, coarse, thick ware, made without the use of the wheel, unglazed, without handles, sometimes ornamented with thumb marks on a strengthening band round the widest part or on the rims. This pottery formed the bulk of all that was found; it is exactly similar to the pottery found in so very large a proportion in the souterrains investigated under the auspices of this society, and is without room for question, contemporary, and possibly even in some instances of pre-souterrain period. It is usually and probably correctly attributed to the seventh century and earlier; probably as early as pre-Christian times. times. (Nos. 121, 135-7).

B. Rough, unglazed, wheel-turned pottery, thinner in texture than A., but unornamented, and also without handles. In most, if not all cases, the wheel turned pots were globular, with lip turned outwards, thus forming a sort of neck, round which might have been wound a rope or strap for lifting the vessel off the fire. In all cases the vessels of A. and B. type were heavily sooted on the outside, showing that they had been used as cooking vessels. This type of pottery is usually put down to the seventh century and later; it probably overlapped with its preceding type A., as well as its succeeding type C. (No. 134).

C. Rough wheel turned pottery, ornamented with herringbone or dotted designs, glazed, and in some cases coloured, principally green. Many showed the presence of

handles, and some were evidently pieces of large water jars, or amphorae, graceful in shape, oval, with narrow necks, and handles joining the neck with the body. These vessels bore no marks of soot. They are clearly known in England as of Norman introduction, and in Nendrum, undoubtedly of about 12th century and later (No. 133).

Types A. and B. are made from local clay. Some twelve inches below the sod, a few feet N. of the Round Tower was found what was evidently the site of a pottery of type A. Here lay countless fragments of half baked broken pots, and lumps of fire-hardened clay bearing the marks of the potter's thumb and hand and fingers, indicating that with his right hand he had been pressing clay with his thumb on to a pot against his left hand, the side of the pot being between (No. 138). From the position and level of the site of this pottery, as compared with the foundation of the Round Tower, one is forced to the conclusion that its age is considerable, probably many centuries earlier than that of the tower. From the extreme crudeness of the pottery it may with strong probability go back to pre-Christian times. Possibly this find should have had a special grade in the pottery classification as " pre-A."

Messrs. Josiah Wedgwood & Sons, Ltd., of Etruria, are conducting some interesting experiments with the local Nendrum clay; these experiments are not complete, but so far have produced valuable results. The clay in its natural state is very dirty, but on being strained through fine lawn is capable of being made into excellent pottery, which fires at an exceptionally low temperature. Messrs. Wedgwood have made a few articles of the slip after straining; these they baked in several graduated heats; where the heat was raised beyond a low temperature the articles squatted, that is, became soft like wax, and lost their shape, although emitting a good inherent glaze. When fired at a low temperature, the result showed a ware of attractive appearance of a light chocolate colour and hard texture.

The pottery of types A. and B. were placed by the potter, when shaped, on an open fire made of hay; all the specimens retain the impress of the hay on the bottoms of the vessels (Nos. 137-8); the heat generated by the open fire in this method sufficed to " fire " the pot. All the pot fragments showed that they were made from the local clay

without any process of cleaning it from the fine gravel and other impurities it contained. Messrs. Wedgwood are making reproductions of Nendrum pots under conditions as near as possible to those in which the ancient potters worked, and it is hoped that those experiments will achieve important results, which may be expected to be completed in a few weeks' time.

In conclusion, a glance at the plan will show how far the work has proceeded up to the middle of October, when it was suspended. The middle or second cashel has been repaired, except in that section where Major Blakiston-Houston's and Mr. George Clark's bungalows stand; these are right on top of this section of the middle cashel. It is only right to say that when the sites for these bungalows were originally chosen no one knew that they were being built on the cashel; Mr. Clark has repaired a section of the wall of the cashel adjoining his grounds, but under the circumstances it would be impossible to do any more to the south sections of the inner and second cashels.

The third or outer cashel has been repaired only on the north side; its outline on the west side has been exposed in places to show the position it occupied before it was almost entirely removed; from the south-west round by the south and east up to the north-east remains unrepaired. In parts it has in times past been removed, but in other parts it has not, and could be repaired if the necessary funds were forthcoming. The site of the monk's cells between the inner and second cashels has been excavated where the dotted portion is shown on the plan, but a considerable area of this remained untouched when the season closed.

As to whether the Society can continue the work at Nendrum, which it has carried out during the spring and summers of two years, with such important results, is a matter for the future. Private individuals have contributed to the cost of the work liberally, but the Executive Committee hesitates to issue further appeals to private individuals to carry out a work which has proved to be one of National importance. The Government of Northern Ireland is yet in its infancy; the portion of the endowment of the old Office of Public Works, which fell to Northern Ireland, only amounts to £117 per annum for the upkeep of all the National monuments in the Six Counties. If the Govern-

ment of Northern Ireland, or the general public individually, wish the work at Nendrum to be completed, it is for them to decide; if they care to have it done, and put up the necessary funds, the Executive Committee will gladly carry on the work to a finish.

The Executive Committee desire to thank especially Professor R. A. S. Macalister for the invaluable assistance and advice he gave them in the work; before proceeding to Palestine he came over from Edinburgh to visit Nendrum; his experienced eye at once detected many avenues by which investigation might lead to important results. To his suggestions many of the results that have been achieved are due. It is pleasing to put on record that he expressed entire satisfaction as to the manner in which the repairs of the ruins had been carried out, and his emphatic opinion as to the immense importance of the investigation in regard to the study of the archaeology of the Hiberno-Celtic Christian period.

Also the Rev. Canon Carmody (now the Very Rev. The Dean of Down) gave the benefit of his deep knowledge of Irish history and antiquities; though much occupied in diocesan and parochial work he managed frequently to visit Nendrum, and on endless occasions by his tactful and erudite advice, guided those engaged in the work in the right direction. Major Blakiston-Houston gave continual and enthusiastic help, and being resident on the spot during the summer, was always at hand to render invaluable assistance in carrying out the investigation. For the information of visitors to Nendrum, pending the issue of the Society's reports, he issued, at his own expense, two pamphlets dealing with the investigations and the history of Nendrum, which were highly appreciated.

The Marquis and Marchioness of Londonderry were also frequent and much interested visitors at Nendrum, and in various ways assisted in furthering public interest and support in the investigation.

Two visitors to Nendrum are entitled to special mention, the son and daughter of the two important personages to whom the re-discovery of Nendrum, eighty years ago, must be attributed:—Ex-County-Inspector Reeves, son of the late Bishop Reeves, and Miss Elizabeth Stone, of Barnhill, the sole surviving daughter of Mr. Guy Stone, who in 1844 assisted Bishop Reeves in his discovery of Nendrum.

The Society is under a deep debt of gratitude to its hon. secretary, Mr. Arthur Deane, M.R.I.A., curator of the Belfast Municipal Museum, and his assistants, Mr. Sydney Stendall and Mr. A. George. All the minor relics, as found, were brought up to the Museum, and, under the skilful and experienced hands of these gentlemen, their natural deterioration through exposure to the air was stayed. Of many of the more important relics, plaster casts were made at the Museum, and visitors to Nendrum, who have not seen the relics in the Museum, may thus be able to inspect exact replicas in the tea house, as well as some of the originals, which Mr. Johnston wished to be kept on the spot.

I should like on my own behalf to thank the members of the Executive Committee for their cordial co-operation and advice in all important questions which arose during the work. Without their co-operation and that of Major C. Blakiston-Houston I fear the work would not have proceeded so smoothly as it did. Too much praise cannot be given also to Mr. A. G. Johnston, the proprietor of Nendrum, and his family, who at all times went out of their way to facilitate us in carrying out the work.

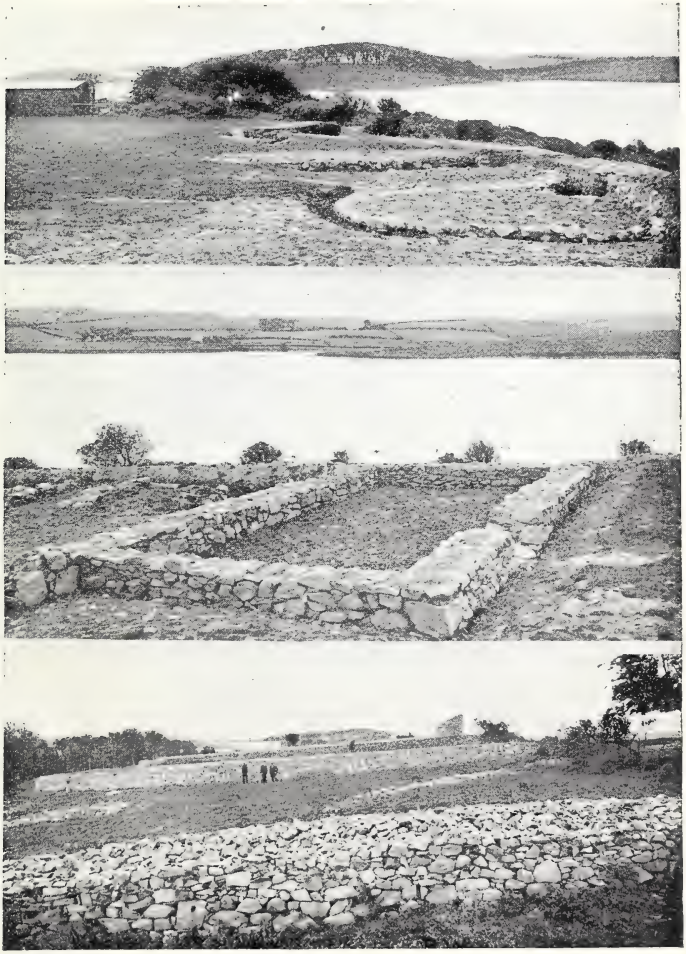
Photos by Mr. R. J. Welch, M.Sc., M.R.I.A.

KEY TO PLAN.

1. Church Nave.
2. Church Chancel.
3. Exedra.
4. Site of Cell (?)
5. Foundation of Walled-in Square.
6. Round Tower Stump.
7. Site of very early Pottery.
8. Remains of Paved Paths (or floors).
9. Site of Monks' Seat (?)
10. }
11. } Gates of Inner Cashel.
12. }
13. Remains of Circular Building in Hollow.
14. Circular Cell (?)
15. Fragments of very Ancient Walls.
16. Angle of Walls where Bell was found.
17. }
18. } Sites of Circular or Oval Buildings.
20. }
19. The Brazier's Workshop.
21. Deep Oven or Sweathouse (?)
22. The School.
23. Remains of Square Building.
24. Protecting Dyke wall built round Church (Modern).
25. Sundial.
26. West Gate of 2nd Cashel.
27. West Gate of 3rd Cashel, Leading to Quay.
28. Foundations of Janitor's Cell.
29. Circular Hollow.
30. Large Midden.
31. Causeway.
32. Mounds of Bones.
33. Monks' Well.
34. Modern Bungalows.
35. Modern Fences.
36. Graves.
37. Large Stone.

Approximate Scale, 60 feet to 1 inch.

PLATE I



1. SITE OF CIRCULAR HUTS. COLMAN'S BAY IN DISTANCE.
2. REMAINS OF THE SCHOOL AFTER CLEARING THE DEBRIS.
3. VIEW OF THE THREE CONCENTRIC CASHELS, FROM THE NORTH.

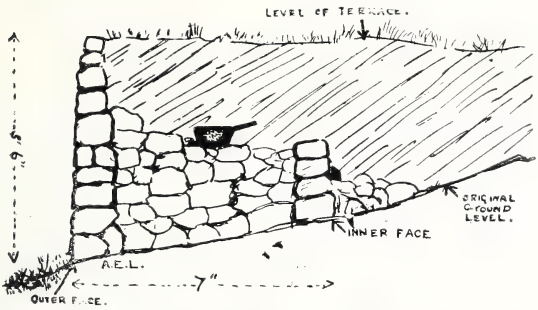
BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

PLATE II

THE BELL OF NENDRUM.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

PLATE III

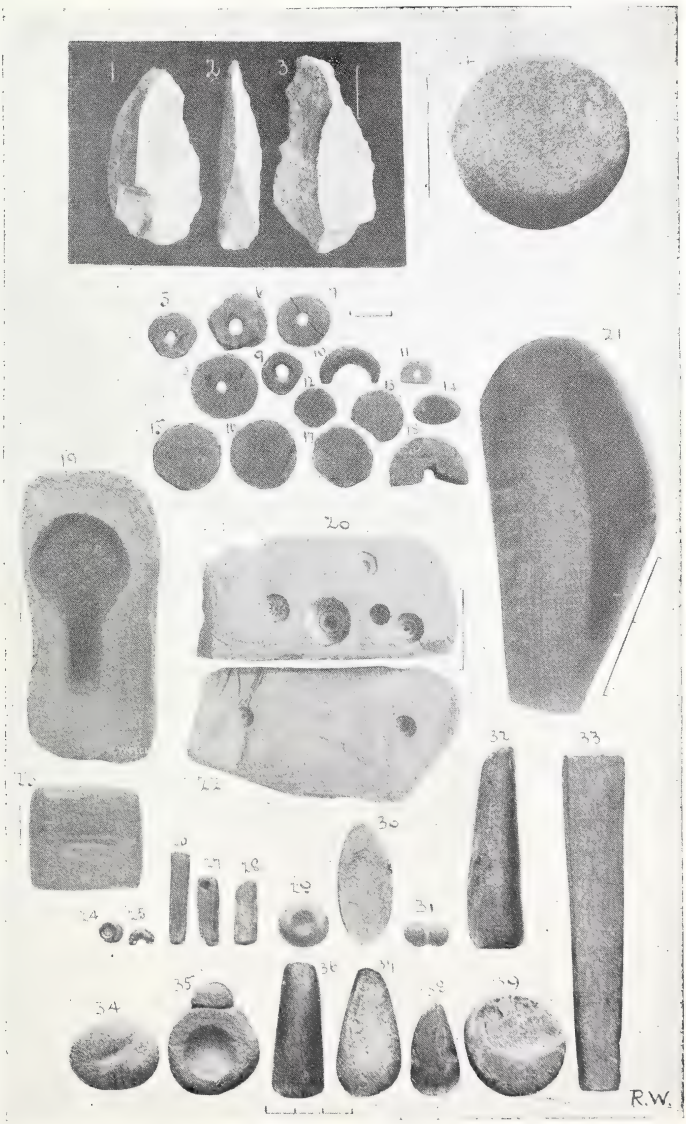


SECTION OF CASHEL WALL SHEWING POSITION OF POT.

SUN DIAL.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

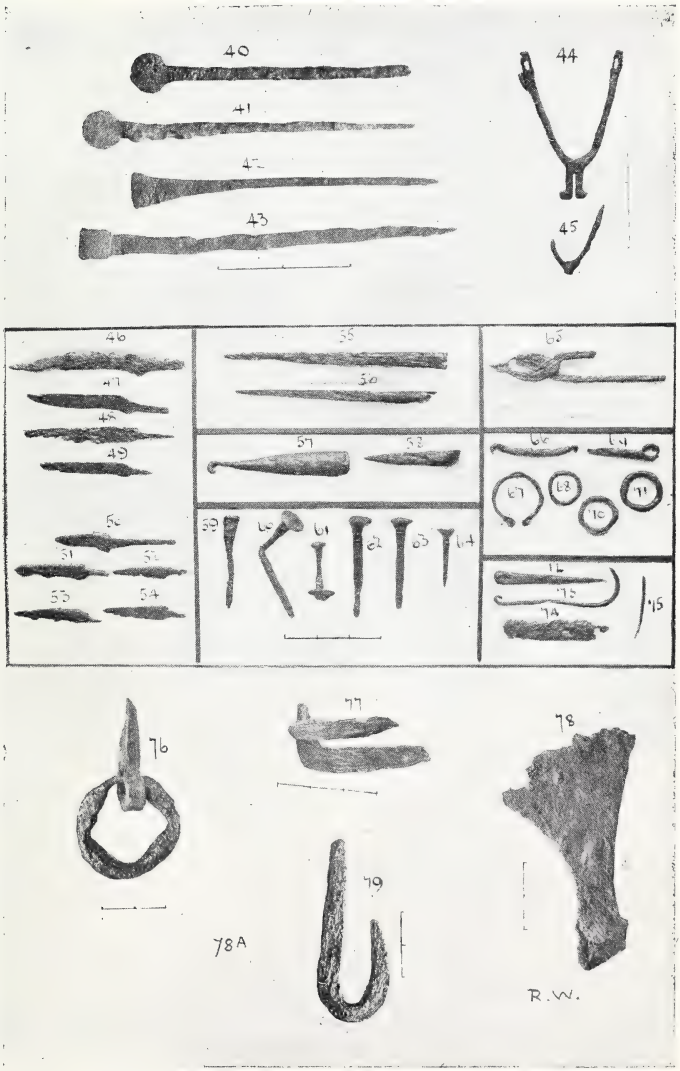
PLATE IV



STONE IMPLEMENTS, ETC ; VARIOUS SITES.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

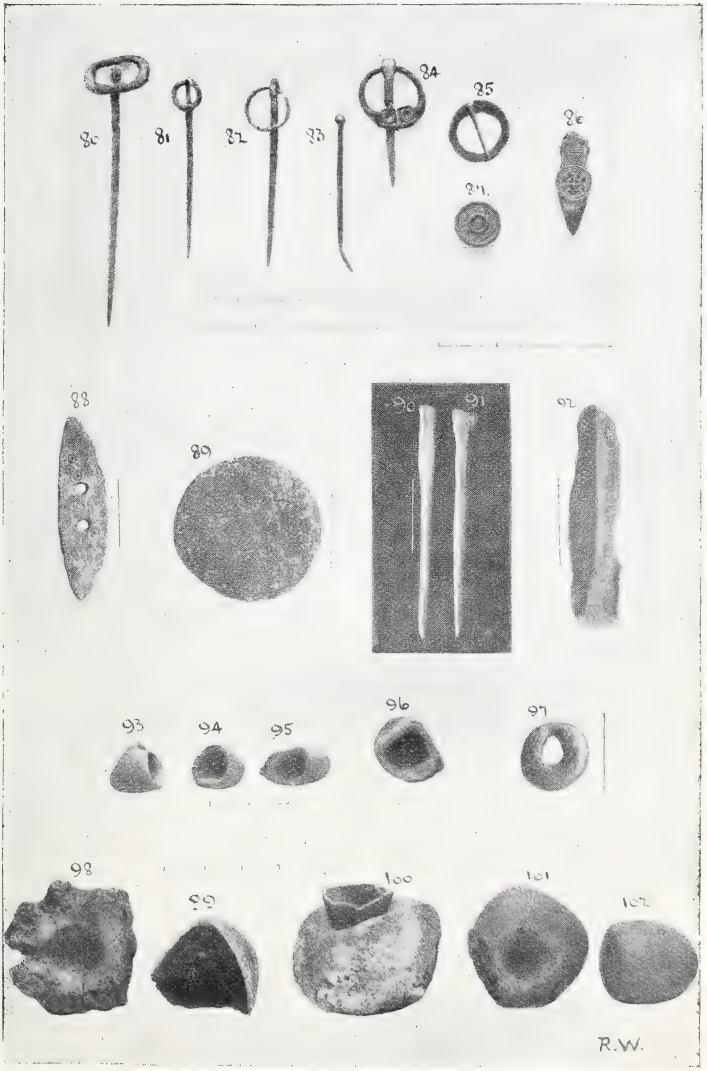
PLATE V



IRON IMPLEMENTS, ETC., VARIOUS SITES.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

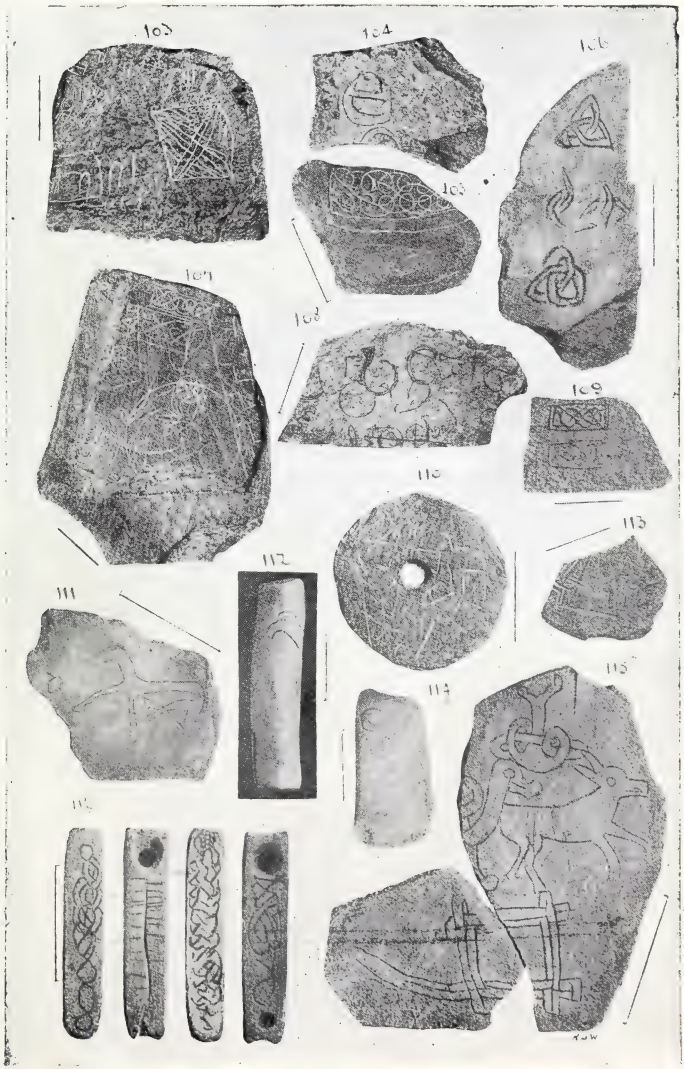
PLATE VI



CRUCIBLES AND HOLDERS, BRONZE PINS AND BROOCHES, MISCELLANEOUS.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

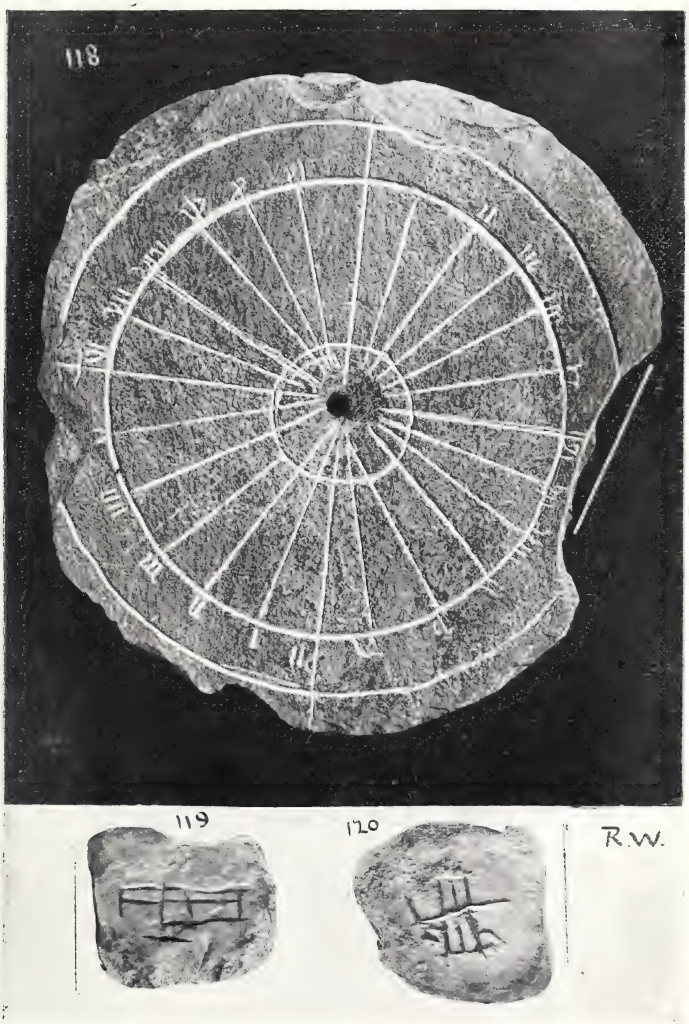
PLATE VII



TABLETS, ETC., FROM SCHOOL.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

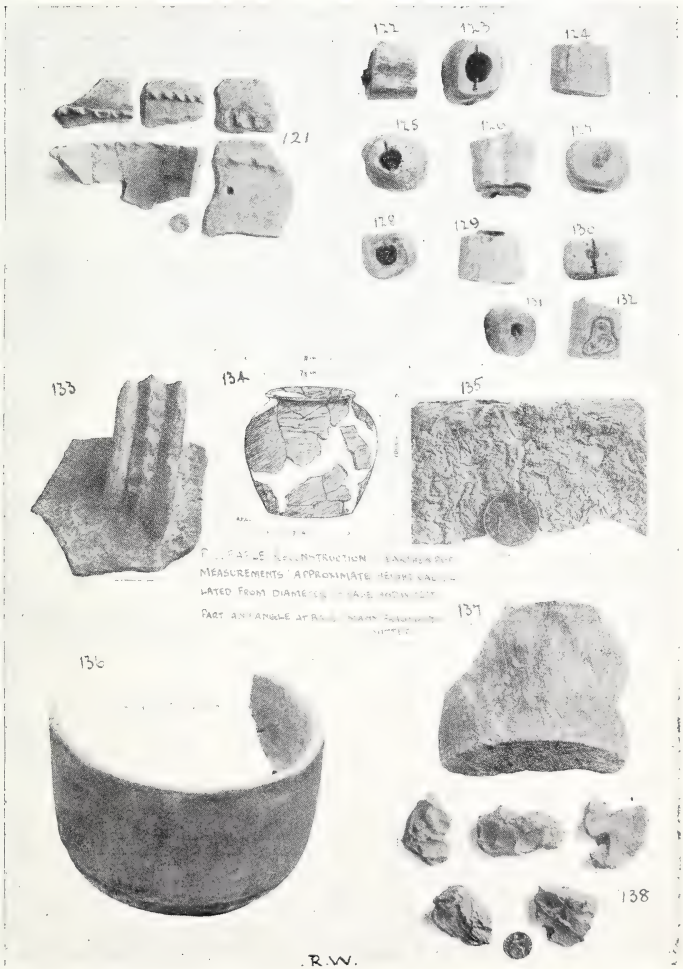
PLATE VIII



SLATE CLOCK DIAL AND STONE SEAL (?)

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

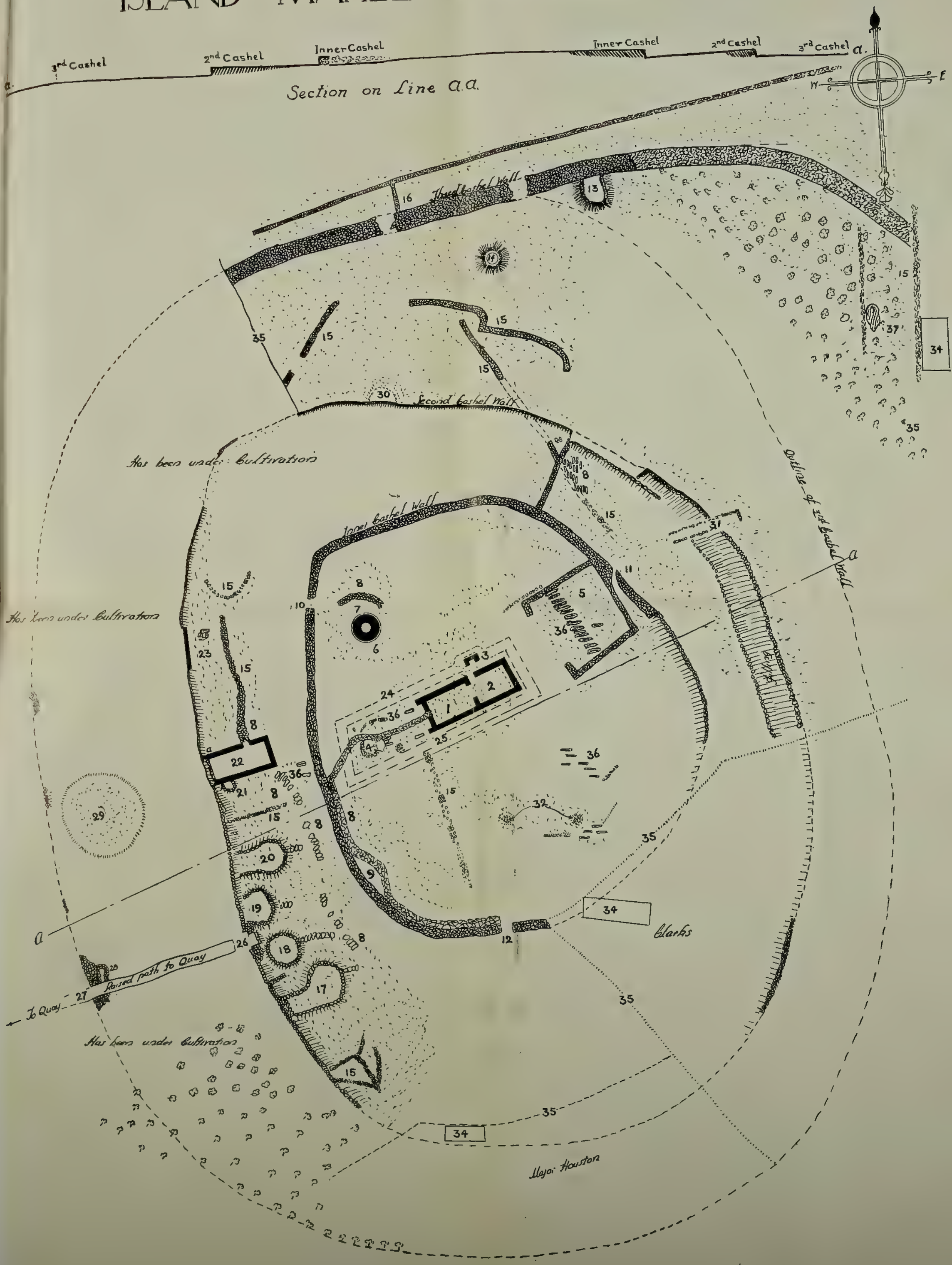
PLATE IX



FICTILIA AND BONE BEADS.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

NENDRUM CELTIC MONASTERY
ISLAND MAHEE Co DOWN



Approximate Scale, 60 feet to one inch.

BRITISH
MUSEUM
23 DEC 24
NATURAL
HISTORY.

ERRATA.

In the Plan of Nendrum, on the east side, is a dotted line marked "outline of 3rd Cashel Wall." Early in the spring (1924), on clearing a wilderness of thorn and bramble at the N.E. corner, it was found that the outer cashel extended eastward, down to the end of the Tea House, where all trace of it is lost. It evidently continued along the site of the present roadway, rejoining an existing fragment S.E. of Mr. Clark's bungalow. It is now apparent that the material of this section of the outer cashel was used by the monks at some period for the construction of the fish pond. On the site of the dotted line referred to, there was at some time a wall or rampart; but the material of this has, like the corresponding section of the main cashel, been completely removed. Thus the plan is, in this respect, misleading.

The Monk's Well ,in transcribing a somewhat indistinct figure "3," appears in the plan as 35. It should read 33.

EDUCATIONAL ENDOWMENTS (IRELAND) ACT, 1885.

The Account of Belfast Natural History and Philosophical Society for the year ended 31st August,, 1923.

Dr. **Cr.**

CHARGE.									CREDIT.								
To Subscriptions	...	...	...	...	£554	6	1		By Balance as per last Account	...	...	...	£20	17	0		
,, Dividends	...	...	...	...	28	17	5		,, Maintenance of Premises, &c.	...	...	...	5	17	2		
,, Rents	...	...	...	...	150	0	0		,, Rent, Rates and Taxes	...	...	...	31	13	10		
,, Income Tax Refund	...	...	...	...	5	8	0		,, Salaries	...	...	...	20	0	0		
Balance against Account on 31st August, 1923			...		123	12	5		,, Printing and Stationery	...	...	...	117	16	2		
									,, Postages, &c.	...	...	...	15	0	0		
List of Securities.									,, Advertisements	...	...	...	37	7	10		
4½ per cent Debentures, York St. Spinning Co.	...	£400	0	0					,, Other Payments, viz. :—								
5 per cent. 1929/47 War Loan	...	305	5	3					Lecturers	...	...	£32	14	0			
									Rent of Rooms for Lectures			12	10	0			
									Lanterns and Slides for Lectures			13	13	0			
									Hire of Piano and Carriage	...		1	15	0			
									Archæology	...	...	545	13	9			
									Audit Fee	...	...	1	1	0			
									British Association	...		1	10	0			
									Bank Interest	...	...	4	15	2			
															£613	11	11
Total,					£862	3	11		Total,						862	3	11

We certify that the above is a true account.

E. J. ELLIOTT, Governor.

W. B. BURROWES, Accounting Officer.

31st day of August, 1923.

I certify that the foregoing Account is correct,

G. BRYAN, Auditor.

22nd day of December, 1923.

IN ACCOUNT WITH THE BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

ARCHAEOLOGICAL SECTION.

Income and Expenditure Account to 31st August, 1923.

Dr.		Cr.	
To Balance	£142 1 7	By Nendrum Account	£545 13 9
,, Subscriptions	474 18 7	,, Lantern Slides	13 13 0
		,, J. Adams Account	15 15 3
		,, Blocks	3 5 8
		,, Balance	38 12 6
	£617 0 2		£617 0 2

SUBSCRIPTIONS TO MAHEE FUND.

2ND LIST.

	£	s.	d.
Andrews, Rt. Hon. Lord Justice	1	1	0
Andrews, Rt. Hon. J. M., M.P.	1	0	0
Atkinson, Arthur S.	1	0	0
Barton, H. D. M.	4	0	0
Barbour, J. Milne, D.L., M.P.	2	2	0
Bèbe, Charles	1	0	0
Bell, Mr. and Mrs.	2	0	0
Boyd, David	1	0	0
Boyd, John	1	1	0
Brady, J.	1	1	0
Brett, Sir Charles	5	0	0
Bristow, J. R.	2	0	0
Brown, Thomas	1	0	0
Bruce, Mrs.	1	0	0
Campbell, James	1	0	0
Clarke E. S.	1	0	0
Corbett, John	1	1	0
Despard, V. D.	1	0	0
Dobbs, Miss M. E.	5	0	0
Down County Council (for repair of castle) ...	30	0	0
Dundas, Rev. W. H.	0	5	0
French, E. J.	0	5	0
Gamble, Miss	1	0	0
Gray, W. P.	1	1	0
Harden, The Misses	0	10	0
Herdman, A. T.	1	0	0
Herdman, Ernest	1	0	0
Heron, Francis A., D.L.	25	0	0
Houston, Major and Mrs. C. Blakiston	4	14	6
Johnston, S. A.	1	0	0
Kinghan, W. S.	2	0	0
Ledgerwood, N. J.	0	10	0
Lepper, R. S.	3	3	0
Leslie, R. W.	1	1	0
Loopbridge Weaving Co., Ltd.	1	1	0

	£	s.	d.
M'Cready, H. L.	1	0	0
M'Cormack, Miss MacNeil	5	0	0
M'Gowan, Thos.	2	0	0
M'Kee, S.	1	0	0
M'Kinley, Rev. Canon, P.P.	2	0	0
Mayne, H. H.	1	1	0
Montgomery, Harford H.	2	0	0
Moore, J. S.	0	10	6
Murray, T. N.	0	2	0
Nolan, Dr.	1	1	0
Nugent, Roland	1	0	0
Pollock, The Rt. Hon. H. M., M.P.	2	0	0
Raphael, George	1	0	0
Reade, J. S.	1	0	0
Reid, D. D., M.P.	2	2	0
Rentoul, Dr. J. L.	2	2	0
Richardson, Mrs. A. W.	3	3	0
Richardson, J. S. W.	1	1	0
Rogers, W. E.	2	2	0
Sawers, T.	5	0	0
Sharman-Crawford, The Rt. Hon. R. G., M.P.	10	0	0
Shaw, Mrs. G.	1	0	0
Sides, W. S.	1	1	0
Sinclair, Mrs. S. and T. A.	1	0	0
Sinton, Alfred	10	10	0
Sheils, Edward	0	10	0
Shillington, C. T.	2	0	0
Stalker, John	1	0	0
Stevenson, John	1	0	0
Stone, Miss E.	3	0	0
Thompson, John	0	10	0
Torrens, T. H., D.L.	2	2	0
Union Club, some kind members of	6	10	0
Wallace, The Right Hon. Col., D.L.	2	2	0
Workers Educational Association per W. K. Knox	1	10	1
W. J. C.	1	1	0
Collection Box at Nendrum	14	15	2
	£202	12	3

EXCHANGES.

Ann Arbor—Publications of the University of Michigan.

Basel (Switzerland)—Verhandlungen der Naturforchenden Gesellschaft in Basel, 1921-22 .

Bergen (Norway)—Publications of the Bergen Museum.

Cambridge (u.s.a.)—Bulletins and Annual Report of the Cambridge Museum of Comparative Zoology.

Cambridge—Proceedings of the Cambridge Philosophical Society.

Colorado Springs—Publications of the Colorado College.

Dublin—Proceedings of the Royal Dublin Society.

Edinburgh—Proceedings of the Royal Society of Edinburgh.

,, Transactions and Proceedings of the Botanical Society, Edinburgh.

Glasgow—Proceedings of the Royal Philosophical Society, 1920-22.

Halifax—Proceedings and Transactions of the Nova Scotian Institute of Science, 1919-20.

Indiana—Proceedings of the Indiana Academy of Sciences 1920-21.

La Plata (Argentine)—Obras Completas y Correspondencia Cientificia de Florentino Ameghino.

Lawrence—Bulletins of the University of Kansas.

Lima (Peru)—Boletin del Cuerpo de le Ingenieros de Minas del Peru.

London—Quarterly Journal of the Royal Microscopical Society.

,, Publications of the Geological Society.

LOUSANNE—Memoirs and Bulletins de la Societe Vaudoise des Sciences Naturelles.

MADISON—Bulletins of the Wisconsin Geological and Natural History Survey.

MADRAS—Report of the Government Museum of Madras, 1921-22.

MELBOURNE—Proceedings of the Royal Society of Victoria.

MEXICO—Anales del Instituto Geologico de Mexico.

NEW HAVEN—Transactions of the Connecticut Academy of Arts and Sciences, 1922.

ORONO—Bulletins of the Maine Agricultural Experiment Station.

OTTAWA—Publications of the Geological Survey of Canada, Department of Mines.

PARIS—Publications of the Geological Society of France.

PHILADELPHIA—Publications of the Academy of Natural Sciences of Philadelphia.

,, Proceedings of the American Philosophical Society.

PUSA—Reports of the Agricultural Research Institute, 1921-22.

RENNES—Bulletin de la Societe Geologique.

ROCHESTER (N.Y.)—Proceedings of the Rochester Academy of Science.

SAN FRANCISCO—Proceedings of the Californian Academy of Sciences.

ST. LOUIS—Public Library Monthly Bulletin and Annual Report.

TORONTO—Transactions of the Royal Canadian Institute.

VIENNA—Verhandlungen der Geologischen Staatsanstalt, 1921-22.

WASHINGTON—Annual Report of the Smithsonian Institution.
,, Annual Report and Bulletins of the United States National Museum.
,, Publications of the Bureau of American Ethnology.
,, Bulletins of the Smithsonian Institution.
,, Contributions from the United States National Herbarium.
,, Proceedings of the United States National Museum.
,, Smithsonian Institution, Miscellaneous Collections.
,, Publications of the United States Geological Survey.
ZURICH (Switzerland)—Vierteljahrsschrift der Naturforchenden Gesellschaft in Zurich.

BELFAST NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

Officers and Council of Management for 1923-24.

President:
PROFESSOR W. B. MORTON, M.A., M.R.I.A.

Vice-Presidents:
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ARTHUR DEANE, M.R.I.A.

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PROFESSOR A. W. STEWART, M.A., D.SC.	
SIR CHARLES BRETT, LL.D.	*Retire 1925*
T. EDENS OSBORNE, F.R.S.A.I.	
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W. B. BURROWES, F.R.S.A.I.	*Retire 1926*
E. J. ELLIOTT.	
H. C. LAWLOR, M.R.I.A.	
WILLIAM SWANSTON, F.G.S.	
PROFESSOR GREGG WILSON, D.SC., M.R.I.A.	

SHAREHOLDERS AND MEMBERS.

Corrected to 30th November, 1923.

[**Denotes Holders of three or more Shares.*]

[*a* ,, *Members of Archaeological Section.*]

*a*Acheson, F. W., 37 Osborne Park, Belfast
*a*Acheson, Mrs. M. K. 67 Eglantine Avenue, do.
*a*Acheson, M. K., M.D., do. do.
*a*Adams, Rev. Wm., M.A., The Manse, Antrim
Adams, John, Auburn, Cranmore Park Belfast
*Alexander, Francis, B.E. do.
Alderdice, Richard Sinclaire, 7 Wellington Place, do.
Allingham, Robert, North Street do.
Allworthy, S. W. M.D., Manor House, Antrim Road, do.
*Anderson, John, J.P., F.G.S. (Representative of), Holywood, Co. Down
*a*Anderson, Frank, M.B.E., Willoughby Terrace, Portadown
*a*Andrews, Michael C., F.R.G.S., F.R.S.G.S., Orsett, Derryvolgie Avenue, Belfast
Andrew, John, L.D.S., R.S.C.ENG., 23 University Sq. do.
*a*Andrews, Miss Elizabeth, 10 Park Crescent, Tonbridge, Kent
Archer, Rev. Canon, B.D., Seagoe Rectory, Portadown
Armstrong, Hamilton, Corlea, Ashley Park, Belfast
*a*Atkinson, Arthur S., Dromana, Knockdene Park, do.

*a*Baird, Major William, J.P., Royal Avenue, do.
Beaumont, Ivor, A.R.C.A., School of Art, do.
*a*Bennett, S. A., B.A., B.SC., Campbell College, do.
Bennett, J. L., B.A., Helen's Bay
*a*Berry, Colonel, M.R.I.A., Ardluin, Newcastle
Bigger, Francis J., M.R.I.A., F.R.S.A.I., Ardrigh, Antrim Road, Belfast
Bingham, John A., M.P.S.I., 43 Donegall Place, do.
*a*Birch, J. P., Ashfield House, Ravenhill Road, do.

Blair, John G., 3 Victoria Gardens Belfast
Blakiston-Houston, C., Myode, Bloomfield, do.
*a*Blake, R. F., F.I.C., 4 Knock Road, do.
Boyd, Thornton, Blackstaff Spinning Company, do.
*a*Boyd, Miss Kathleen St. Clair, Chatsworth, University Road, do.
Boyd, John, San Remo, Holland Park, Neill's Hill, Belfast
*a*Brett, the Venerable Archdeacon, M.A., Montrose, Fortwilliam Park, do.
*a*Bristow, James R., M.A., Woodville, Malone Park, do.
Bristow, John, 10 College Square North, do.
*Brown, George B., Lisnamaul, Ormeau Road, do.
Brown, J., M.A., B.SC., 33 Marlborough Park (centre), do.
*a*Burrowes, W. B., F.R.S.A.I., Ballynafeigh House, Ravenhill Road, do.
*a*Byrne, J. Edwards, 37 Royal Avenue, do.

Calwell, R. I., C.B.E., B.E., M.I.C.E., Carninard, Annadale Avenue, do.
Cameron, G. A., Institution Road, Coleraine
Campbell, A. A., F.R.S.A.I., Drumnaferrie, Rosetta Park, Belfast
*Campbell, Miss Anna (Representatives of), do.
*a*Carmody, The Very Rev. W. P., Dean of Down, Downpatrick
Carr, A. H. R., 22A Donegall Place, Belfast
Carrothers, E. N., 145 Stranmillis Road do.
*a*Carter, C. S., 7 Knockbreda Road, do.
*a*Carter, H. R., 28 Waring Street, do.
*a*Chambers, R. M., M.I.MECH.E., 126 Malone Avenue, do.
*Charley, Phineas H., Coolbeg, Cultra, Co. Down
Clark, Sir George S., Bart., D.L., Dunlambert, Belfast
*a*Clarke, John, Antrim Arms Hotel, Glenarm
*a*Cleland, A. McI., Macedon, Green Road, Knock, Belfast
Corbett, Miss K. M., Ardsallagh, Derryvolgie Avenue, do.
Combe, Barbour & Co., Ltd., do.

*a*Crawford, W. M., B.A., I.C.S., F.E.S., Orissa, Marlborough Park, Belfast
*a*Cromie, Thomas M.D., Clough, Co. Down
Cromie, A. G., 1 Antrim Road, Belfast
Crymble, H., 40 Wellington Place, do.
Culbert, J. C., M.P.S.I., 172 North Road, do.
*a*Cunningham, Right Hon. S., Fern Hill, Ballygomartin Road, do.
Cutler, H. A., M.INST.C.E., City Hall, do.

Davies, A. C., Lenaderg House. Banbridge, Co. Down
Davin, Miss A. G., Glenmore Lodge, Lambeg
*a*Davis, Colonel, 21 Malone Park, Belfast
Davison, A. H., F.A.I., 32 Wellington Place, do.
*a*Deane, Arthur, M.R.I.A., Municipal Art Gallery and Museum, Royal Avenue. do.
Deans, T. M., LL.D., Academy House, Rosetta, do.
*Deramore, Lord, D.L.,
Despard, V. D., 10 Academy Street, do.
Devoto, V. A., Kilmorna, Glastonbury Avenue, do.
Dixon, Professor, M.A., SC.D., F.R.S., St. Ives, Bladon Drive, do.
*Donegall, Marquis of (Representatives of), do.
*Downshire, Marquis of, The Castle, Hillsborough, Co. Down
Duffin, Adam, LL.D., J.P., Dunowen, Cliftonville, Belfast
Dunleath, Lord, Ballywalter Park, Ballywalter, Co. Down

Earls, Professor J., B.A., Municipal College of Technology, Belfast
Ewart, G. Herbert, M.A., J.P., Firmount, Antrim Road, do.
Ewart, Fred W., M.A., B.L., Derryvolgie, Lisburn
Ewart, Sir Robert H., Bart., Glenmachan House, Belfast
Elliott, David, J.P., B.A., Ardroe, Bloomfield, do.
Elliott, E. J., The Towers, Donegall Park Avenue, do.
*a*Faren, William, F.R.S.A.I., 45A Waring Street, do.

*Fenton, Francis G., 5 Rue Cervaux, Paris
*a*Ferguson, G. W., C.E., J.P., Carnamenagh, Antrim Road, Belfast
Finlay, Archibald H., Willesden, Holywood
Finlay, Robert H. F., Victoria Square, Belfast
Finlay, W. J., 10 High Street, do.
Finnegan, John M., B.A., B.SC., 23 Botanic Avenue, do.
Fitzsimons, N., F.R.I.B.A., 92 Myrtlefield Park, do.
Forsythe, J., Lisadell, Cliftonville Road, do.
*a*Frazer, Kenneth J., Hillmount, Cullybackey
French, E. J., St. Anne's, Donnybrook, Dublin
Fry, W. Arthur, High Street, Holywood
Fulton, G. F., Arlington, Windsor Avenue, Belfast

Geale, R. G., 40 Wellington Park, do.
*Getty, Edmund (Representative of), do.
Gibbon, Lt.-Col. W. D., D.S.O., M.A., Campbell College, Belfast
Gibson, Andrew, F.R.S.A.I., Fairfield, Lansdowne Road, do.
Gibson, S., J.P., Summerhill, Dunmurry, Co. Antrim
Gibson, W. H., O.B.E., D.SC., F.I.C., F.INST.P., York Street Flax Spinning Co., Belfast
Gibson, W. K., 16 Chichester Street, do.
Goldsbrough, J. B., Central Public Library, do.
Gordon, J. S., D.SC., Ministry of Agriculture, do.
Gordon, Malcolm, Dunarnon, Unversity Road, do.
Gourlay, R. J., Central Public Library, do.
Gray, Miss H. I. A., c/o Miss Lang, 29 Colenso Parade do.
Green, H. Percy, Limehurst, Holland Park, Knock
*a*Greeves, F. M., Garranard, Strandtown, Belfast
*a*Greeves, Joseph M., Bernagh, Circular Road, do.
*a*Greeves, Arthur, Altona, Strandtown, do.
*a*Greeves, John Theo., Nendrum, Knockdene Park, do.
*a*Greeves, W. Leopold, 11 Ormeau Road, do.
Grogan, James, 2 Orient Gardens, do.
Grogan, J., junior, do. do.

Hale, W. Barcroft, 6 Salisbury Gardens, Belfast
*Hall, Frederick H., Waterford
Hamilton, Rt. Hon. and Rev. Thomas, M.A., D.D., LL.D., Vice-Chancellor Queen's University, Belfast
*Hamilton, Hill, J.P. (Representatives of), do.
Hanson, W. M., St. John's Villa, Holland Park, do.
Harland, Capt. W., 4 Psalter Lane, Sheffield
*a*Hastings, S. R., J.P., Church Street, Downpatrick
Hastings, Archibald, 7 Cavehill Road, Belfast
Hawthorne, John, B.A., PH.D., F.I.C., 16 Donegall Square S., do.
Hayward, Harold R., Hopefield House, Antrim Road, do.
*a*Henderson, R. G., 65 Atlantic Avenue, do.
Henderson, J. W., M.A., Methodist College, do.
*a*Henry, Professor R. M., M.A., M.R.I.A., Crosshill, Windsor Avenue North, do.
*a*Henry, T. W., F.S.ARCH., Greenbank, Mountpleasant, do.
Herdman, E. C., Carricklee House, Strabane
*Herdman, Robert Ernest, J.P., Merronhurst, Craigavad, Co. Down
*a*Heron, F. Adens, D.L., J.P., F.R.S.A.I., Maryfield, Holywood
*a*Hewton, John, M.P.S.I., Ava Pharmacy, 315 Ormeau Road, Belfast
Heyn, James A. M., Head Line Buildings, do.
Higginson, R. E., 20 Waring Street, do.
*a*Hill, S. W., M.D., 46 Pound Street, Larne
Hind, John, 22 Cliftonville Road, Belfast
*a*Hogg, A. R., 10 Thorndale Avenue, do.
Hodges, Miss, Old Spout Farm, Rotherfield, Sussex
*a*Holness, John J., 26 Ava Street, Belfast
Honneyman, Wm. B.SC., (LOND.), F.I.C., 18 Halstein Drive, Ballyhackamore, do.
Hoskins, A. Percy, F.I.C., F.C.S., 14 Rosetta Park, do.
**a*Houston, John Blakiston, D.L., J.P., Orangefield, do.
*Hughes, Edwin, Craigavad, Co. Down.

Hummel, Professor, M.SC., A.M.I.C.E., Queen's University, Belfast
Hunter, Dr. J. A., 6 Stranmillis Road, do.
Hunter, William, J.P., Fortwilliam Villas, do.
Ireland, J. Herbert, 102 South Parade, do.

*a*Jaffé, W., 10 Donegall Square South, do.
James, Wm., L.D.S., 93 Gt. Victoria Street do.
Jamieson, Andrew (Andrew Jamieson, Ltd.), Sandy Row, do.
Jenkins, J. C., 86 University Road, do.
*a*Johnston, E. C., F.R.S.A.I., Glenmount, Newtownards
Johnston, Samuel A., J.P., Dalraida, Whiteabbey, Co. Antrim
Jones, H. H., 2 Wilmont Terrace, Belfast
*a*Jury, P. M., Brooklands, Dunmurry

*a*Kendall, S. O., 47 Adelaide Park, Belfast
*Kinghan, John R., Windsor Avenue (Representatives of), do.
Kinkead, G. W., Chellowdene, Jordanstown, do.
Knox, Major S. W., LL.B., Glenburn, Dunmuury do.
Kyle, Robert Alexander, 15 Wellington Park, do.

Laird, Professor J., M.A., 4 Cranmore Gardens, do.
*a*Lamb, G. C., Leura, Finaghy, do.
Larmor, Sir Joseph, M.A., D.SC., LL.D., F.R.A.S., Sec. R.S., St. John's College, Cambridge
*a*Lawlor, H. C., M.R.I.A., 8 Windsor Avenue, Belfast
*a*Lepper, R. S., M.A., F.R.HIST.S., F.R.S.A.I., Elsinore, Crawfordsburn, Co. Down
Lewars, D. B., 17 Dundela Gardens, Bloomfield, Belfast
Lindsay, Professor J. A., M.A., M.D., F.R.C.P., Queen's Elms, do.
*a*Loewenthal, John McC., Lennoxvale, Malone Road, do.
Londonderry, The Marquis of, Mount Stewart, Newtownards
Loughridge, James, 173 Cliftonville Road, Belfast

aLowry, David E., Oakley, Strandtown

*Macrory, A. J. (Representatives of), Belfast
aMagill, Mrs. A. P., 9 Wilmont Terrace, Lisburn Road, do.
aMagill, Hugh, 217 Cavehill Road, do.
Magill, John E., Eversley, Whitehead
aMackie, James, J.P., Albert Foundry, Belfast
Malcolm, Bowman, M.I.C.E., M.I.MECH.E., Inver, Ashley Park, Antrim Road, do.
Malcolmson, Herbert, Riverside, Holywood
Maxton, James, M.I.N.A., M.I.MAR.E., 6 Kirkliston Drive, Belfast
aMayes, William, Kenmuir, 12 Deramore Park South, do.
Mayne, H. Horner, 24 Elmwood Avenue, do.
Mercer, S. P., Hanging Leaves, Jordanstown
Mercier, Mrs. W. C., Garvock, Green Road. Knock
aMercier, S. T., J.P., 2 Mount Clifton, Cliftonville Road. Belfast
aMerrick, A. S., 32 Wellington Park, do.
Metcalfe, A. W., Hawthornden House, Hawthornden Road, do.
Milligan, A., 4 Cooke Street, do.
Mitchell, Robert A., LL.B., T.C.D., Marmount, Strandtown, do.
Moneypenny, Sir Frederick, C.B.E., C.V.O., City Hall, do.
aMontgomery, Miss E. S.. 26 College Green, do.
aMontgomery, H. C., F.R.S.A.I., 40 Rosemary Street, do.
aMontgomery, H. H., 17 Malone Park, do.
Moore, Harold M., 26 Wellington Place, do.
aMorton, Professor W. B., M.A., Glencarse, Nottinghill, do.
Muir, A. H., 7 Donegall Square West, do.
Muskett, A. E., 12 Belgravia Avenue do.
Mullan, William, Lindisfarne, Marlborough Park, do.
*Murphy, Isaac James (Representatives of), Armagh

*Murphy, Joseph John (Representatives of), Belfast
*Musgrave, Henry, D.L. (Reps.), Drumglass, Malone, do.
*a*Macalister, Professor, R.A.S., D.LITT., M.A., 18 Mount Eden Road, Donnybrook, Dublin
McBride, A. H., Ormeau Avenue, Belfast
*McCalmont, Robert (Representatives of), London
*McCammon, Thos. P. (Representatives of), Woodvale, Holywood, Co. Down
McCance, Captain Stouppe, 4 Markham Square, London, S.W.3
McCaughey, John, 79 Somerton Road, Belfast
*a*McCoy, B., F.R.S.A.I., 84 Smithfield, do.
McCoy, W. R. S., 27 Damascus Street, do.
*McCracken, Francis (Representatives of),
*a*McCready, H. L., M.A., 104 Myrtlefield Park, do.
McDowell, Chas. Stephen, B.SC., 33 Wellington Park, do.
McGill, J. F., Ardoyne Cotage, Ardoyne, do.
*a*McGowan, Thomas R., 73 Ann Street, do.
McIlveen, J. H. M., Irene, Parkmount Road do.
MacIlwaine, Dr. John E., 26 College Gardens, do.
MacKenzie, W. G., A.R.H.A., The Studio, Clarence Place, do.
*a*McKisack, H. L., M.D., Chlorine Place, do.
McKisack, C. J., 9 Mount Pleasant, do.
MacLaine, Alexander, J.P., Queen's Elms (Representatives of), do.
*a*McMeekin, Adam, J.P., Cogry House, Doagh
MacMillen, Rev. J., M.A., D.D., 151 Ravenhill Road, Belfast
McMullan, P. J., J.P., Churchfield, Holywood
*a*McNeill, George, 12 Deramore Park, Belfast

Napier, N. J. F., M.I.C.E., City Hall, do.
*a*Neill, F. F., 35 Candahar Street, do.
Nelson, Captain G. M., 2 Howard Street, do.
Newel, J. F., 25 Lombard Street, do.

Nicholl, J. W., 25 High Street, Belfast
Nicholl, William, 10 St. James' Street, do.
*a*Nolan, Dr. M. J., Resident Medical Superintendent, Asylum, Downpatrick
O'Neill, J. B., 26 Cromwell Road, Belfast
Orr, Dr. Gawn, Ballylesson, do.
Orr, James, 17 Garfield Street, do.
*a*Osborne, T. Edens, F.R.S.A.I., 4 College Square N. do.
Owen, D. J., 22 St. John's Park, Blackheath. London

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